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WILLIAM THOMAS COUNCILMAN

JANUARY 1, 1854–MAY 26, 1933

By Dr. HARVEY CUSHING

THROUGHOUT his long life Councilman was a man of ardent and generous enthusiasms. It was this quality, combined with his utter informality, which made him such an inspiring teacher for the young and such a delightful companion both for young and old. There was a picturesque ruggedness in his personal appearance, an unexpectedness in his turn of thought, a shrewdness and independence in his observations concerning people, things and events that set him apart from the common mould. He had escaped from early educational and environmental inhibitions by which many persons come to be afflicted and subdued. Combined with an utter unconsciousness of self, there was about him a certain sturdiness of mind, frankness of opinion and honesty of purpose which were no less disconcerting to the self-complacent than refreshing to those who appreciated his outspoken sincerity.

He was born on a busy farm which straddled the Reistertown turnpike not far from Baltimore, and he always regarded it as fortunate that his early years were passed in such an environment. There he learned to plow, to swing a cradle, to bind sheaves of grain and do other things that were unforgettable, like the gathering of Spring simples.

The very earliest thing I can remember [he wrote in one of later-year addresses] is being taken by my grandfather when he set out in the first warm days of early spring with a grubbing hoe (we called it mattock) on his shoulder to seek the plants, the barks and roots from which the spring medicine for the household was prepared. If I could but remember all that went into that mysterious decoction and the exact method of preparation, and with judicious advertisement put the product upon the market, I would shortly be possessed of wealth which might be made to serve the useful purpose of increasing the salaries of all pathologists. . . . But, alas! I remember only that the basic ingredients were dogwood bark and sassafras root, and to these were added *qu. s.* bloodroot, poke and yellow dock. That the medicine benefited my grandfather I have every reason to

believe, for he was a hale, strong old man, firm in body and mind until the infection came against which even spring medicine was of no avail. That the medicine did me good I well know, for I can see before me even now the green on the south hillside of the old pasture, the sunlight in the strip of wood where the dogwood grew, the bright blossoms and the delicate pale green of the leaf of the sanguinaria, and the even lighter green of the tender buds of the sassafras in the hedgrow, and it is good to have such pictures deeply engraved in the memory.

Sent off to school at St. John's College, Annapolis, he left there at the age of sixteen and for the next six years 'led an independent existence, raised side whiskers, considered himself a very ripe individual and did pretty much as he chose.' That he was always something of a rebel and disinclined to do anything which did not interest him, he in after years frequently confessed. But at the age of twenty-two, the determination struck him to follow in the footsteps of his father, a country doctor "who had never lost the childish desire to find things out by observation and the test of experiment."

He entered the Medical School of the University of Maryland which was no better nor worse than most schools of the period, the two-year course consisting largely of a series of lectures. The dissecting room, however, provided the contact with Nature for which he yearned, and the form and structure of the body soon fired his curiosity. Fully to satisfy this, the farm provided an excellent opportunity and, beginning with the mole, he proceeded to make a comparative study of the skulls of all available animals until the collection finally threatened to crowd him out of his bedroom. So engrossed did he become in this occupation he largely neglected his second-year course of lectures; and it was not wholly a misfortune that one day during his absence a little nephew 'with a good business head' sold the whole collection for a few cents to an itinerant bone merchant. This grievous episode, by driving him back to his lectures, made it possible for him to attain, in March of 1878, the degree 'qualifying him to exercise the art of medicine which he had so laboriously learned for the advantage of the public.'

Then something notable happened and what this was can be best told fragmentarily in his own words, though properly to do so the scene must be shifted and the calendar advanced to 1921, a full forty-three years.

As the Christmas recess drew near, it was noised about in the Harvard Medical School that on December 19th Professor Councilman was for the last time to conclude his course of lectures on pathology for the second-year class. Entering the large amphitheater to find it packed to the doors by members of all classes, his face became suffused at the burst of applause and then, abandoning his intended discourse, with his engaging hesitancy of speech slightly more pronounced than usual, he said in effect:

"It is plain to see that you regard this as an occasion marking an epoch in my life, and there is a tendency to regard an epoch as an excuse for remarks. The three great epochs of life are birth, marriage and death, and they are often accompanied by certain remarks. At the wedding breakfast many have suffered from these remarks and some of us have made them. The present is a sort of intermediate epoch and though my talk is usually desultory I may take advantage of the occasion to be even more vague and desultory than usual."

By good fortune someone wrote down his impromptu ruminations and though they can not be quoted in full, interesting as that would be, some excerpts will serve to show what it was that happened after his graduation in March of 1878.

> . . . I heard that there was at the Johns Hopkins University a new sort of institution called a laboratory. I vaguely knew of the Johns Hopkins University but not a great deal about it. It had opened in 1876 and Huxley came on to give the opening address; my father drove in from the country and heard this address and he came back and told us what an impression it had made on him. . . . There seems something remarkable about the opening of this University. . . . The men, Martin, Rowland, Brooks, and Remsen, were young men, and as young men they felt no hampering traditions. Traditions may be very important, but they can be extremely hampering as well, and whether or not tradition is of really much value I have never been certain. Of course when they are very fine, they do good, but it is very difficult of course ever to repeat the conditions under which good traditions are formed, so they may be and are often injurious and I think the greatest progress is made outside of traditions. So the Johns Hopkins University started without traditions, and started with young men, full of vigor and enthusiasm, as its leaders. The University at its beginning made provision for twenty fellowships, each fellow being paid five hundred dollars; and *the idea of going to a university and being paid for it* made an impression!

He then went on to tell of Martin's permitting him to join his small class in the biological laboratory for the next three months and how thrilled he was with the informal spirit of the place and with the method of teaching through observation and experiment. That summer he became assistant to the quarantine officer, bought a cheap microscope with his first small earnings, and began with its aid to study such histological preparations as he could find time to make in the intervals of his routine work. And when that autumn Martin offered him the assistantship in

physiology for the following year his cup was overflowing.

For the first paper he ever wrote (an experimental study of inflammation of the cornea) he was given a prize of one hundred dollars and with this encouragement he might well enough have been tempted to take up biology as a career. But something else proved a greater lure: for during the summer months of the three years since his graduation he had been at work, partly at the Marine Hospital and partly at the Bayview Asylum (the city almshouse and hospital) meanwhile becoming ardently interested in histological pathology. Properly to pursue this subject further, he decided that he must go abroad, which his frugal savings permitted him inexpensively to do.

He could scarcely have gone at a more fortunate time, for almost daily new discoveries were being made and new methods developed. In 1880 German medicine was approaching its heyday, under the stimulus of the new cellular pathology and the cultivation of pathogenic bacteria, both greatly aided by the increasing use of analine dyes in the study of tissues and micro-organisms. His longest sojourn was passed in Vienna under men who had been brought up in the tradition of Rokitansky. For a considerable time he was with Recklinghausen in the new school at Strassburg. He was working under Cohnheim and Weigert in their active laboratory at Leipzig when in April 1882 the exciting news was brought of Koch's discovery of the tubercle bacillus. And a year later he is found with Hanns Chiari, a man of his own age, whom he had first known in Vienna but who now held the chair of pathology in Prague. From this place under the date of July 16, 1883 a certain "correspondent," W.T.C., sent off to the *Medical News* an entertaining letter largely given over to a vivid description of the ordinary mid-day meal served in that part of the world.

So in his final lecture—to which, from this digression we may again turn—he went on to say:

> I came back from Europe very full of all the things which I had learned and with a more or less definite idea of . . . practising medicine. But I put off later and later the putting up of a sign showing that I was willing to serve, and finally never put it out, because it seemed to me there were so many other interesting things to do. And as long as one saw the possibility of doing these interesting things without actual starvation, there was no question of the choice, and there should never be a question of the choice. I reasoned that if worse came to worst I had a few acres of good land on which I could raise all the food I required and something over, . . . but I never had to resort to agriculture for a living. I speak of this because at that time there seemed to be no possibility of earning a living by teaching pathology, and Welch in New York and I were probably the first two men in the country who tried it. I rather think Dr. Welch took the greater risk because he had not my agricultural resources, though a training and mental capacity far greater than mine.

For the next few years after his return from abroad in 1883 he engaged in various tasks, doing the autopsies at Bayview, teaching in the two local medical schools, helping John S. Billings prepare his National Medical Dictionary, writing articles for encyclopoedias, and for a year serving as Coroner's physician to the City. This position paid him three hundred dollars, but it 'tied him down too much to places and dates' and 'being of a rather roving disposition' he 'did not care to be at a certain place at a certain time,' so he surrendered the job to another physician who had a greater political pull.

Meanwhile, in 1886 he had joined Welch and the early group of workers in the newly erected pathological laboratory which was to form part of a great hospital still in slow process of erection. And with the opening of the Johns Hopkins Hospital three years later there came another period as remarkable, he believed, as the first period, that of the opening of the University. To prepare himself for this event, in which he was slated to take part, he had gone abroad in 1888 for another year of study; and then for the two years prior to the establishment of the Medical School, in close intimacy—

> There lived together in the hospital a group of men, all young, all very good fellows, all working very hard, and all having a very good time. It is an important thing that people should be happy in their work, and if work does not bring happiness there is something wrong; and both at the University and at the Hospital there was that wonderful happiness in work.

All others who shared in that cloistered, carefree, hard-working and stimulating life in the Johns Hopkins Hospital during those two early years have expressed themselves in similar vein and there may never be anything quite like it again. Of this 'mutual admiration society,' as it was dubbed by visitors who had enjoyed its warm hospitality, the acting resident pathologist with the title of Associate Professor was one of the conspicuously unique figures. And it is natural that he should have been among the first of many to be called away by other institutions which were eager to capture something of the local spirit, hoping that it might prove transplantable.

Accustomed as a second-year student to the formal lectures then in vogue at the Harvard Medical School, the writer well remembers what an impression was made by the addition in 1892 to a somewhat austere faculty of this breezy informal pipe-smoking man, unmistakably sloping toward the sunny side, who was

said to have been the first 'outsider' ever appointed to a professorial chair in the School. Accustomed to work elbow to elbow with others, those of us who cared to do so and knew enough to take advantage of the opportunity were welcome to a chair and a desk and a problem in his laboratory.

Indelible pictures of him must remain etched on the memory of all who had even casual contact with him in those early days in Boston when mayhap target practice was being held in the laboratory on a Sunday morning. He was a deadly shot for a thumbtack in a plank at twenty paces; and could swear at a golf ball as could few others. He was one of those rare people able without giving offence to punctuate quiet speech with oaths (even when talking to himself); and he depended upon and made considerable fuss over his occasional tipple preferably of Maryland rye. The growing up, later on, of his devoted children hampered him considerably in the first of these diversions—at least when at home; and what he thought of the Volstead Act and its necessary subterfuge does not bear repeating.

As can be seen from some of the quotations that have been given, he did not always necessarily expect to be taken seriously, particularly when in one of his pessimistic moods usually precipitated by examples of human selfishness he had happened to observe. But even these occasional outbursts had their amusing aspects, which would make him laugh (and swear) both at himself and the world. Someone has said that his attitude toward life and its varied experiences was more like that of Mark Twain than of anyone else he had ever known. And not to misjudge the lessening optimism and buoyancy of his later days, it may without impropriety be said that for sixteen years before his sudden end he had been victimized by increasingly severe attacks of angina pectoris.

But let us return again to the valedictory remarks of the retiring Professor of Pathological Anatomy on that December day of 1921, and we find him saying in conclusion:

> It seems to me that the most important thing for the teacher is to awaken interest and enthusiasm in his students and to provide them with opportunities of following the interest which is aroused, for in this way we progress. Knowledge can not be given, it must grow and be slowly formed through one's own efforts. It is of no importance whatever to be talked to. I have always rather enjoyed lecturing, I like to talk, and I have gotten I am sure more out of the lectures than any of my listeners, because a lecture is often an important discipline to the teacher. It enables him to classify things in his mind; through the lecture he often acquires new ideas. I know that sometimes as I have been lecturing I have seen an unscalable wall rising before the trend of my argument, and I have realized that if I said the next two or three sentences I would run against that wall, and one acquires a nimbleness of wit in finding a way around to the other side. I have enjoyed all that, and I think lecturing is an intellectual stimulus and comparatively harmless to the audience . . . it does not really very much matter what the lecturer says.

During those thirty years of consecutive teaching in a school which profited greatly by his ferment, he engaged in many time-consuming researches; and much as he loved to play, when once on a scientific quest he pursued it relentlessly and lived with his problem. While his independent papers deal with a large number of significant and timely subjects, he was more interested in fostering the work of his associates and pupils than in communicating the results of studies carried out by himself alone. Hence, the names of one or more collaborators appear on most of his major publications. Thus his early work on malaria (1885) was shared with A. C. Abbott; his monograph on amoebic dysentery (1891) with H. A. Lafleur; that on epidemic cerebrospinal meningitis (1898) with F. B. Mallory and J. H. Wright; the studies of 220 fatal cases of diphtheria (1901) with F. B. Mallory and R. M. Pearce; a syllabus of pathology for students (1904) with F. B. Mallory; and the several important studies on variola and vaccinia (1891–92) were subsequently brought together (1904) in a monograph under the names of his several coworkers, G. B. Magrath, W. R. Brinckerhoff, E. E. Tyzzer, E. E. Southard, R. L. Thompson, I. R. Bancroft, and G. M. Calkins.

Obviously what fostered the making of the larger number of these conjoint investigations was the opportunity, which contemporary epidemics afforded, of intensively studying the several diseases with which these papers deal; but at the same time sight was not lost of the opportunity for public service to the community in which the epidemics were causing alarm.

On the opening in 1913 of the Brigham Hospital to which he was appointed pathologist, the scope of his work was greatly enlarged though at the same time his responsibilities were doubled. The larger part of his time came to be passed in the hospital and the departmental protocols of the day are models in their thoroughness of detail. The lengthened number of hours he was obliged to spend in the microscopical study of dead tissues may possibly have served to accentuate—if anything could—his love of the outdoors and his interest in growing things.

Disturbed by the architecturally unadorned exterior of the new hospital, he personally selected, planted and during his odd hours cultivated the well chosen varieties of rambler roses that still surround it; and

when so engaged, nothing gave him greater delight than for passers-by to mistake him for the official gardener. He had a gift for making things grow and was forever planting and tending shrubs and flowers somewhere. One of his chief joys was the Arnold Arboretum and his knowledge of every shrub and tree in that marvellous place was scarcely exceeded by that of his greatly admired friend, Charles S. Sargent, the Director. The horticultural interests now shown by certain members of the hospital staff of those days can probably be traced to the Sunday morning rambles in the Arboretum or elsewhere through the country in company with Councilman and Pasco, his devoted bulldog, who scarcely ever left his side.

By nature a close observer, this quality was further developed by the exercise of his profession and it was inevitable that he should look about him with greater keenness and more curiosity than most persons. Though a wide and discriminating reader, what he saw with his own eyes he questioned and interpreted in his own terms. He was, in its broad sense, a naturalist, and all things interested him. Two unusual opportunities came to him to gratify his fondness for travel and desire at first hand to study the unfamiliar flora of other regions. In 1916, he accompanied the Rice Expedition to the Amazon; and two years after his retirement at Harvard, having been invited temporarily to join the staff of the Pekin Union Medical College, he took advantage of this to go around the world. He had a gift of description and was a most facile writer of highly entertaining letters which, usually undated, he would dash off on the sheets of ruled yellow paper which he kept ready at hand.

It might be supposed, by the unthinking, that those whose chosen occupation is the study of disease and death would in time become callous and indifferent to life. On the contrary, it is more apt to lead to an abhorrence of suffering of any kind and to a peculiar tenderness toward living things. In his difficult and often baffling search for the cause of disease by the examination of the dead body, by the microscopic study of the tissues and by the experimental reproduction of its processes in lower animals, the pathologist is laying the foundation on which its recognition, alleviation or possible cure by physician or surgeon during life is alone possible. It is a task requiring optimism, patience, intelligence and self-sacrifice of unusual degree. And to show what outlet a pathologist may have, this inadequate tribute to one of them may well close with an allusion to something else.

On relinquishing his chair and with it his hospital position, Councilman merely shifted his attention from the diseases of man to those of plants, and his last printed paper, issued from the Arnold Arboretum, was the result of a microscopic study of the relation of the fungi of its essential humus to the root-system of *Epigaea repens*. As befitted its place of publication in the *Proceedings of the National Academy of Sciences*, it was a detailed presentation of a novel and little studied subject couched in scientific terms. But it was characteristic of him that he could not leave the trailing arbutus without unburdening himself in regard to its "fatal gift of conspicuous beauty" even though his feelings must be relegated to the footnote in which he says:

> The Epigaea repens is one of the most beautiful and interesting of plants. Its blossoms which are among the earliest of the spring flowers are white or pink with a waxy texture and a delicious spicy odor and are borne at the extremities of the stems. The pale green hairy leaves and the pale pink or green stems streaming from the centre close upon the surface of the soil add to the attractiveness. The environment of dead brown leaves, mosses and low plants give a perfect setting. It is unfortunate that these wonderful qualities should be those which are ensuring the destruction of the plant. Large quantities are gathered in the spring and hawked around the city streets, the unfortunate city dwellers seeking to satisfy atavistic and misunderstood yearnings for woods and green dales by purchasing the bunches. . . . The automobile by rendering remote places easily accessible has contributed greatly to its destruction, but the most powerful agency is the commercial exploitation which is ruthless and the traffic of great extent. Where the plants are abundant a family even selling them at wholesale can often earn $25.00 a day . . . but the plant is of slow growth and the relation of leaf and root is so finely adjusted that recovery after considerable loss does not take place and the stimulation to effect new growth cannot act on the plant and the fungus at the same time. By great care and skill plants can be transferred to other suitable localities and may even be propagated by seed but there is little prospect of its ever becoming a garden habitant. . . . I have known it to disappear completely from localities where formerly common and probably no plants can now be found within a dozen miles of any of the large cities. This desire to save the plant is not a mere matter of sentiment. No plant is more suitable for . . . the awakening in children through its study the all important wonder and curiosity. . . .. Apparently like all wild beautiful things which man covets it must go but the loss of such things is a serious loss for man.

Thus Councilman went through life observing, studying, recording and speculating on things small and on things large, but always with consuming interest in the quest that engaged him and living up to his maxim that the chief happiness lies in work. When uprooted from his warm and fertile Maryland soil and transplanted to the rugged shores of Puritan New England, there must have clung to him some of

the 'essential native humus' which guaranteed more than a precarious foothold. Though 'deeply engraved on his memory' was the bursting springtime of his boyhood home, he came to appreciate no less the beauties of a slower year's awakening. So it is suitable to leave him—engrossed in the study of the tiny Mayflower and vigorously championing its right to survive.

A HISTORY OF THE NATIONAL RESEARCH COUNCIL 1919--1933

V. DIVISION OF GEOLOGY AND GEOGRAPHY[1]

By Professor W. H. TWENHOFEL
CHAIRMAN

THE Division of Geology and Geography was organized in 1918 for the purpose of assisting in the prosecution of the war and was reorganized in 1919 to serve the interests of the sciences in time of peace. The membership of the division at first was placed at twenty-six and later twenty-seven, of which nine members were to be elected at large, one as the representative of the Division of Federal Relations of the National Research Council, and the others chosen by the national societies of geology and geography. Experience soon demonstrated that a large membership was too expensive for the work of the division and also too large for efficient work, and in 1928 steps were taken to reduce the membership gradually to nineteen, which was completely effected by 1932. Since this reduction it has seemed that still greater efficiency and less expense would be attained by further reduction, and this view coincided with the recommendations of the Committee on Policies of the National Research Council, which urged that the executive members of the divisions be reduced to a number not greater than twelve. This reduction in membership is now in process and it is planned, beginning July 1, 1933, to have three members-at-large and nine members chosen by the national societies. It is felt that this reduction will permit centering more responsibility upon the members of the division and thus, in turn, lead to greater interest on the part of the membership.

The division does its work very largely through committees, but there is also much work done through personal contacts of the officers and members of the division with other geologists and geographers. The committees are concerned with a wide range of objectives. The number has varied through the years and at the present time there are twenty-four, the membership of a committee ranging from four to twenty. The motive prompting the appointment of a committee is one of hope of development of a neglected or backward branch of geology or geography through having a group of students interest itself with the branch of geology or geography concerned. In this way advance to a notable degree has been made in several fields of geology and geography, among which are: batholithic problems, studies of the clay minerals, isostasy, measurement of geologic time, micropaleontology, oceanography, paleobotany, petroleum geology, processes of ore deposition, sedimentation, shore-line investigations and tectonic geology. Two recently appointed committees are those on stratigraphy and the accessory minerals of crystalline rocks, and it is confidently expected that substantial advances will be made in those fields. At the present time over 200 geologists and geographers are centering attention on the work of the twenty-four committees, and great credit is due to the chairmen and members who give time and energy to the work of the division.

The roster of chairmen since the organization of the division is as follows:

1918 —John C. Merriam
1919–1922—E. B. Mathews
1922–1923—Nevin M. Fenneman
1923–1924—Andrew C. Lawson
1924–1927—David White
1927–1928—Waldemar Lindren
1928–1931—Arthur Keith
1931–1933—W. H. Twenhofel

The extent of the advance in the work of a committee rests on several factors, among which are, first and most important, the initiative, leadership and industry of the chairman, and, second, the nature of the problem. A committee is discontinued when its work has been concluded through solution of the problems upon which its attention was centered or through development of interest on the part of another organization prepared to assume responsibility for continuation of the work. The division does not attempt duplication of work, and when it is found that a competent organization is prepared to assume responsibility for further development of a project the division willingly retires from the field.

[1] This is the fifth of a series of ten articles prepared to describe briefly the nature of the activities with which the National Research Council has been engaged during the past fourteen years.

Some years ago the division found that not a great deal was being done in oceanography and a committee was appointed in 1922 to develop this field. This committee studied the problems for a decade and through excellent annual reports of progress stimulated interest in oceanographic problems. Ultimately the work carried on by the committee was undertaken by other organizations that had entered this field both in the United States and abroad, and in June, 1932, the committee brought its activities to an end. A committee on state geological surveys was appointed in 1928 and was discontinued in June, 1932, on the completion of a résumé of the activities since 1910 of the state and federal surveys. A committee to assist in the study of pioneer belts was appointed in 1925 and discontinued in 1928, at which time support for the project was assumed by other organizations and the work has continued under their auspices.

The work of the division may be classified as that of research, education and organization, and its various committees direct attention to one or more of these activities. Some committees, as those on measurement of geological time, clay minerals, tectonics and micropaleontology, are concerned almost entirely with research. Others, as the committees on sedimentation and paleobotany, are concerned with research pertaining to sediments or paleobotany and to education in these fields. The work of the committee on the state geological surveys may be considered essentially educational, and the work of the committees on bibliography of economic geology, conservation of the scientific results of drilling, field data of earthquakes, and the International Geographical Union as that of organization.

The research work of the division has resulted in the publication of several bibliographies, of numerous reports which appear in whole or in part in the annual reports of the division, of bulletins published by the National Research Council, of articles published in geological or geographical journals, and of books published by commercial concerns. Research work carried out on grants made by or through the division is usually published in various scientific journals, and in some instances in the publications of a geological survey.

In addition to the work of committees, the division has assisted in the preparation of bibliographies, in the compilation of maps, in surveys of the fields of work of geology and geography, in cooperative work with other research organizations, and it has served as a liaison body between the scientists of the United States and some of the international geographical and geological congresses.

The division has no direct funds of its own other than an annual allotment from the Research Council to take care of its administrative expenses. Some of the committees, as those on measurement of geologic time, studies in petroleum geology, and sedimentation, through their own efforts have acquired funds for aiding research in the fields concerned. These funds have been derived from various sources and from them, from time to time, small grants have been made to individual workers to assist in the solution of particular problems.

The division participates in the allocation of the funds administered by the Committee on Grants-in-Aid of the National Research Council, the committee being composed of the chairman of the Council and the chairmen of the seven technologic divisions. To date sixty grants for geologic and geographic projects, totalling $36,913.50, have been made to fifty-one individuals by this committee. Through these grants three seismographs have been erected in three different places in the United States, aid has been given to paleontologic and stratigraphic studies over many parts of the country, ranging from the Atlantic to the Pacific and from Canada to the Gulf, and aid for studies in these fields has been extended to include territory in several foreign countries. Mineralogy and petrography have received aid for both field and laboratory studies, and work in geography has been made possible in the United States, Greenland, Mexico, Brazil, Japan, and elsewhere. Applications for grants have been numerous and many have been denied because of insufficient funds, or because the projects presented were of such a nature that they did not come within the bounds of the policies under which the grants-in-aid are administered. It is felt that the two fields of learning represented by the Division of Geology and Geography have been greatly benefited through support derived from these funds, and the records of results are extremely creditable.

For the past three years the division has had the administration of from four to six pre-doctorate fellowships, known as the Storrow fellowships, a fund of $5,000 having been given annually to the division for this purpose. These are granted to students of geology and geography, and the allotment per student per annum has been from $800 to $1,000. For the fellowships given for the year 1932–1933 there were sixty-five applicants, or thirteen applicants for each one chosen, thus clearly showing the needs for fellowship support for geology and geography. The fellows study in any institution approved by the fellowship committee of the division. The division is greatly in need of post-doctorate fellowships in order that students of marked ability in research need not be compelled to accept minor commercial or educational positions to have an income necessary for subsistence.

With several well-supported post-doctorate fellowships the most gifted of the younger geologists or geographers of the country could be retained for one or more years in study and research before settling down to some permanent position. It is believed that in this way very great advance could be made.

During the period 1926–1931 the division, together with the Divisions of Physics and Chemistry, cooperated through the Central Petroleum Committee of the Research Council with the American Petroleum Institute in organizing the work and selecting the personnel for the projects financed by the institute under its five-year program of fundamental research in petroleum. Descriptions of these projects and lists of papers which resulted from these studies have been published in the bulletins of the institute.

One of the bibliographic projects now in progress under the auspices of the division is that of the "Annotated Bibliography of Economic Geology." Sufficient funds were raised by the committee to cover the editorial expenses for a period of about seven years, after which it is hoped that the bibliography will have sufficiently demonstrated its usefulness to enlist further financial support.

As noted in a previous paragraph, records of the work of the division are given in numerous publications. In the annual report of the division for 1931–1932, a history is given which includes an annotated list of some 64 projects undertaken by the division since its permanent organization in 1919. In this history are given details and results of the work of the division not possible of presentation in this short paper. These are tangible results that are possible of measurement. In addition there are the intangible results which are difficult of discovery and equally difficult of evaluation. The several division chairmen, the many different members of the division and the personnel of the committees have stimulated research as they have been brought in contact with their colleagues through membership in the National Research Council or its committees, and they themselves in turn have been stimulated by such contacts. To those familiar with the results of the work accomplished, the record seems an enviable one.

The future of the division is of course unknown, but everything seems favorable for continued development along the paths it has already opened. In the early days there was no doubt much uncertainty as to what the division might do, but, measured by its past record, it has more than justified its founding, and, basing itself on its accomplishments, it may look confidently to the future. As in the past there will be required devoted and loyal workers. The division in part can provide for these in the election of members-at-large and the selection of its committee chairmen, but for the greater part of the membership it must rely upon the societies by which these members are chosen.

SCIENTIFIC EVENTS

ESTABLISHMENT OF THE OFFICE OF NATIONAL PARKS, BUILDINGS AND RESERVATIONS

THE reorganization order of President Roosevelt, establishing the Office of National Parks, Buildings and Reservations, will take effect sixty days from June 10, the date of issue. It is as follows:

All functions of administration of public buildings, reservations, national parks, national monuments and national cemeteries are consolidated in an office of national parks, buildings and reservations in the Department of the Interior, at the head of which shall be a director of national parks, buildings and reservations; except that where deemed desirable there may be excluded from this provision any public building or reservation which is chiefly employed as a facility in the work of a particular agency. This transfer and consolidation of functions shall include, among others, those of the National Park Service of the Department of the Interior, and the national cemeteries and parks of the War Department which are located within the continental limits of the United States. National cemeteries located in foreign countries shall be transferred to the Department of State, and those located in insular possessions under the jurisdiction of the War Department shall be administered by the Bureau of Insular Affairs of the War Department.

The functions of the following agencies are transferred to the office of national parks, buildings and reservations of the Department of the Interior and the agencies are abolished:

The Arlington Memorial Bridge Commission, the Public Buildings Commission, the Public Buildings and Public Parks of the National Capital, the National Memorial Commission and the Rock Creek and Potomac Parkway Commission.

Expenditures by the Federal Government for the purposes of the Commission of Fine Arts, the George Rogers Clark Sesquicentennial Commission and the Rushmore Commission shall be administered by the Department of the Interior.

THE BRITISH ACADEMIC ASSISTANCE COUNCIL

THE formation of the Academic Assistance Council, with Lord Rutherford as president, has been reported in SCIENCE. The official announcement of its objects, issued from the rooms of the Royal Society at Burlington House, London, is as follows:

Many eminent scholars and men of science and university teachers of all grades and in all faculties are being obliged to relinquish their posts in the universities of Germany.

The universities of our own and other countries will, we hope, take whatever action they can to offer employment to these men and women, as teachers and investigators. But the financial resources of universities are limited and are subject to claims for their normal development which can not be ignored. If the information before us is correct, effective help from outside for more than a small fraction of the teachers now likely to be condemned to want and idleness will depend on the existence of large funds specifically devoted to this purpose. It seems clear also that some organization will be needed to act as a center of information and put the teachers concerned into touch with the institutions that can best help them.

We have formed ourselves accordingly into a provisional council for these two purposes. We shall seek to raise a fund, to be used primarily, though not exclusively, in providing maintenance for displaced teachers and investigators, and finding them the chance of work in universities and scientific institutions.

We shall place ourselves in communication both with universities in this country and with organizations which are being formed for similar purposes in other countries, and we shall seek to provide a clearing house and center of information for those who can take any kind of action directed to the same end. We welcome offers of cooperation from all quarters. We appeal for generous help from all who are concerned for academic freedom and the security of learning. We ask for means to prevent the waste of exceptional abilities exceptionally trained.

The issue raised at the moment is not a Jewish one alone; many who have suffered or are threatened have no Jewish connection. The issue, though raised acutely at the moment in Germany, is not confined to that country. We should like to regard any funds entrusted to us as available for university teachers and investigators of whatever country who, on grounds of religion, political opinion or race, are unable to carry on their work in their own country.

The Royal Society have placed office accommodation at the disposal of the council. Sir William Beveridge and Professor C. S. Gibson, F.R.S., are acting as Honorary Secretaries of the Council, and communications should be sent to them at the Royal Society, Burlington House, W.1. An executive committee is being formed and the names of trustees for the fund will shortly be announced. In the meantime checks can be sent to either of the honorary secretaries.

Our action implies no unfriendly feelings to the people of any country; it implies no judgment on forms of government or on any political issue between countries. Our only aims are the relief of suffering and the defense of learning and science.

LASCELLES ABERCROMBIE, S. ALEXANDER, W. H. BEVERIDGE, W. H. BRAGG, BUCKMASTER, CECIL, CRAWFORD & BALCARRES, WINIFRED C. CULLIS, H. A. L. FISHER, MARGERY FRY, C. S. GIBSON, M. GREENWOOD, J. S. HALDANE, A. V. HILL, GEORGE F. HILL, W. S. HOLDSWORTH, F. GOWLAND HOPKINS, A. E. HOUSMAN, J. C. IRVINE, F. G. KENYON, J. M. KEYNES, A. D. LINDSAY, LYTTON, J. W. MACKAIL, ALLEN MAWER, GILBERT MURRAY, EUSTACE PERCY, W. J. POPE, ROBERT S. RAIT, RAYLEIGH, CHARLES GRANT ROBERTSON, ROBERT ROBINSON, RUTHERFORD, MICHAEL E. SADLER, ARTHUR SCHUSTER, C. S. SHERRINGTON, GEORGE ADAM SMITH, G. ELLIOT SMITH, J. C. STAMP, J. J. THOMSON, G. M. TREVELYAN.

HONORARY DEGREES CONFERRED AT YALE UNIVERSITY

DEGREES conferred in the sciences by Yale University on June 21 included the doctorate of science on Dr. Ernest William Brown, Josiah Willard Gibbs professor of mathematics emeritus at the university, and on Dr. Alfred Newton Richards, professor of pharmacology at the University of Pennsylvania. The doctorate of laws was conferred on Dr. Hugh S. Cumming, Surgeon-General of the United States. The degree of master of science was conferred on Dr. William Bosworth Castle, assistant professor of medicine, Thorndike Memorial Foundation, and Boston City Hospital; on Lincoln Ellsworth, New York City, explorer, and on Dr. Alfred Lee Loomis, physicist, director of the Loomis Laboratories.

Candidates for the honorary degrees were cited by Professor William Lyon Phelps, while the degrees were conferred by Dr. Angell.

The citations made in conferring the degrees on Professor Brown, Professor Richards and Surgeon-General Cumming were as follows:

ALFRED NEWTON RICHARDS, SC.D.

Professor Phelps: Professor of pharmacology, University of Pennsylvania. Dr. Richards took his B.A. and M.A. at Yale, and began his career in the Sheffield Scientific School Laboratory of Professor Chittenden. Then he taught at Columbia, later at Northwestern, and in 1910 was made professor at Pennsylvania. During the World War he was attached to the staff of the British Medical Research Committee. In connection with the wide-spread studies of shock he made outstanding observations regarding the occurrence of histamine in minute quantities in the organism and its relation to the behavior of the blood vessels. More recently he has highly developed a unique field of research in regard to kidney function. He has trained many competent investigators, the publications coming from his laboratory being highly important. For many years he has been a guiding influence in the development of academic medicine in Philadelphia. Here is a man whose researches have added to organized knowledge and to the welfare of mankind.

Dr. Angell: Distinguished investigator in a most difficult and important field, inventor therein of delicate and invaluable techniques, a recognized leader in your special department of research, your *alma mater*, proud of your accomplishments, confers upon you the degree of Doctor of Science and admits you to all its rights and privileges.

ERNEST WILLIAM BROWN, SC.D.

Professor Phelps: Professor Brown was born at Hull, England, and received in 1887 his B.A. degree at Christ's College, Cambridge, where two centuries earlier an English poet paid a compliment to Galileo. Professor Brown has won many prizes and is a member of learned societies in America and abroad. In 1891 he became professor of mathematics at Haverford, where he remained until 1907, when he was called to Yale. He became professor emeritus in 1932. His publications on lunar theory and celestial mechanics have given him an international reputation and have added to the glory of Yale. His Tables on the Motion of the Moon is a monumental work and has brought him a blizzard of degrees, medals, prizes and honors. He is an excellent chess player and an amateur humorist of high reputation. In his youth he expected to be a concert pianist, but later took up the music of the spheres. His versatility is additionally shown in that, although he is a specialist on the moon, in the year 1925 in the city of New Haven he arranged a personally conducted total eclipse of the sun.

Dr. Angell: In grateful and affectionate acknowledgment of the luster shed upon her by your brilliant scientific achievement during a long and distinguished service on her faculty, Yale University gladly confers upon you the degree of Doctor of Science, admitting you to all its rights and privileges.

HUGH SMITH CUMMING, LL.D.

Professor Phelps: Born in Virginia, taking his degree of Doctor of Medicine at the University of Virginia, Dr. Cumming was appointed Assistant Surgeon in the United States Public Health Service in 1894, and became Surgeon-General in 1920. In earlier years he made creditable contributions in the field of public health research, particularly in regard to the sanitary conditions of the shellfish industry, but his finest achievements have been during the last thirteen years, in the administration of Public Health Service. When he took control it was a rather undistinguished organization; he gradually transformed it into an institution of which our country is proud, an institution equalled perhaps in no other country except England. Benchwarmers have been progressively lifted and their places taken by able investigators, with the result that during the last five or six years substantial and far-reaching contributions have been made in the study of such nutritional diseases as beriberi, in the investigation of tularemia, Rocky Mountain spotted fever and endemic typhus; in studies on silicosis, and other aspects of industrial hygiene; also in the field of pure science, where researches in the chemical composition of sugars have attracted attention. All these technical remarks simply mean that Dr. Cumming is a first-rate citizen.

Dr. Angell: Eminent representative of a noble profession, essential architect and builder of the Public Health Service of the United States, everywhere recognized as one of the most beneficent of all agencies dedicated to the public weal, in grateful recognition of the intelligence, devotion and skill which you have brought to your duties, Yale University confers upon you the degree of Doctor of Laws, admitting you to all its rights and privileges.

THE CHICAGO MEETING

THE notable meeting of the American Association for the Advancement of Science and the associated societies, which opened in Chicago on June 19 and continues to June 30, will be fully reported in SCIENCE. The meeting was held on the invitation of the Century of Progress Exposition, which, together with the American Association, invited as guests a number of the most distinguished foreign men of science. Those who accepted the invitation and took part in the general sessions and conferences are the following:

OTTO APPEL, Agriculture, Berlin
F. W. ASTON, Chemistry, Cambridge
JOSEPH BARCROFT, Physiology, Cambridge
A. MENDELSSOHN BARTHOLDY, Political Science, Hamburg
JAKOB BJERKNES, Meteorology, Bergen
NIELS BOHR, Physics, Copenhagen
FILIPPO BOTTAZZI, Physiology, Naples
LUDWIG DIELS, Botany, Berlin
JEAN DUFRÉNOY, Agriculture, France
LEOPOLD FEJÉR, Mathematics, Budapest
ENRICO FERMI, Physics, Rome
A. P. M. FLEMING, Engineering, Manchester
R. GOLDSCHMIDT, Zoology, Berlin
HERBERT J. GOUGH, Engineering, London
SIR DANIEL HALL, Agriculture, London
A. V. HILL, Physiology, London
C. U. A. KAPPERS, Anthropology and Physiology, Amsterdam
WOLFGANG KOEHLER, Psychology, Berlin
AUGUST KROGH, Zoology, Copenhagen
TULLIO LEVI-CIVITA, Mathematics, Rome
EMILIO MIRA, Psychology, Barcelona
WILLIAM OUALID, Political Economy, Paris
HENRI PIERON, Psychology, Paris
J. J. SEDERHOLM, Geology, Helsingfors
CHARLES E. SPEARMAN, Psychology, London
T. SVEDBERG, Chemistry, Upsala
R. J. TILLYARD, Entomology and Paleontology, Australia

SCIENTIFIC NOTES AND NEWS

DR. HARVEY CUSHING, who recently retired as Moseley professor of surgery at Harvard University and surgeon-in-chief at the Peter Bent Brigham Hospital, has been appointed first Sterling professor of neurology at Yale University. The chair has been founded through a gift of $300,000 from the estate of John W. Sterling.

DR. JAMES FRANCK, professor of physics at the

University of Göttingen, who refused the offer of the Nazi government to let him retain his position there, has been appointed for the coming academic year Speyer guest professor at the Johns Hopkins University.

AT the commencement exercises at Harvard University the degree of doctor of science was conferred on Professor Harlow Shapley, director of the Harvard College Observatory, and on Dr. George David Birkhoff, professor of mathematics. In conferring these degrees, President Lowell made the following citations: "Harlow Shapley—An astronomer of renown, whose spirit, searching for the center of the universe and the nature of the ultra-galactic nebulae, chafes at observing only from this paltry planet." "George David Birkhoff—First in our land among masters of mathematics, that great tool of science; greater still in the realm of pure imagination."

AT the commencement exercises at the University of Pennsylvania the degree of doctor of science was conferred on Professor Charles W. Burr, of the Graduate School of Medicine.

THE doctorate of science has been conferred by Brown University on Professor Harlow Shapley, director of the Harvard College Observatory, and on the late Frederic P. Gorham, at the time of his death chairman of the department of biology at the university.

DR. HERBERT S. JENNINGS, director of the zoological laboratory of the Johns Hopkins University, received the degree of doctor of science at the commencement exercises of Oberlin College.

THE honorary degree of doctor of science was conferred by the Ohio State University at its commencement, on June 12, on Dr. Edward Francis, of the National Institute of Health, Washington, D. C.

SIR WILFRED THOMASON GRENFELL delivered the commencement address at the ninety-sixth commencement of the University of Louisville on the evening of June 6. The honorary degree of doctor of science was conferred upon him by the university.

DR. C. U. ARIENS KAPPERS, director of the Zentral Institut für Hirnforschung at Amsterdam, received the honorary degree of doctor of laws from the Chicago Medical School, at its eighteenth annual commencement, in recognition of his work in neuropsychiatry.

DR. A. A. BENEDETTI-PICHLER, of the department of chemistry, Washington Square College, New York University, has received the Pregl Prize, awarded annually by the Vienna Academy of Sciences for distinguished work in microchemistry.

DR. ROBERT P. BIGELOW, professor of zoology at the Massachusetts Institute of Technology, who has been connected with the institute since 1893, retires at the end of the academic year with the title professor emeritus. He will be an honorary lecturer at the institute next year.

DR. CHARLES H. RICHARDSON, for more than twenty-five years professor of mineralogy and head of the department at Syracuse University, has retired with the title of professor emeritus of mineralogy. He will continue as director of the natural science museum and will give part of the time to lecturing at the university. On June 19 he received the honorary degree of doctor of science from Norwich University, Northfield, Vermont.

SIR ARTHUR KEITH, who has been for twenty-five years conservator of the museum and Hunterian lecturer of the Royal College of Surgeons, will shortly retire, but will continue his connection with the college. He will have charge of the two laboratories of the college, recently built at Down, in Kent, where Charles Darwin lived. They are endowed by Sir Buckston Browne and are for experimental work in surgery. Sir Arthur will supervise the work of young surgeons who will live and work in Down.

DR. E. MELLANBY, professor of pharmacology at the University of Sheffield, has resigned.

DR. G. A. CLARK, lecturer in physiology at the University of Sheffield, has been promoted to a professorship in succession to Professor J. B. Leathes.

AT a meeting of the court of the University of St. Andrews on June 2, John Anderson was appointed professor of surgery in succession to the late Professor L. Turton Price.

AT the annual meeting of the New Orleans Academy of Sciences, the following officers were elected: Robert Glenk, curator, Louisiana State Museum, *president;* H. H. Beard, Ph.D., biological chemist, Louisiana State University Medical Center, *first vice-president;* E. C. Faust, M.D., parasitologist, Tulane University, *second vice-president;* E. L. Demmon, chief, U. S. Forest Experiment Station, *secretary,* and Dr. D. S. Elliott, dean of the department of physics, Tulane University, *treasurer.*

OFFICERS of the Minnesota chapter of Sigma Xi for the coming year are as follows: *President,* Dr. Samuel C. Lind; *Vice-president,* Dr. Frederic K. Butters; *Secretary,* Dr. Frederick B. Hutt; *Treasurer,* Dr. George A. Thiel; *Board of Electors,* Dr. John E. Anderson, Dr. C. H. Bailey, Dr. Charles A. Mann and Dr. Owen Wangensteen.

AT Syracuse University on May 29, Sigma Pi

Sigma, honorary physics fraternity, installed its twenty-sixth chapter when twenty students, alumni and faculty members were initiated into the society as the Alpha-Beta Chapter. The installing officers were: Dr. Marsh W. White, Pennsylvania State College, *executive secretary,* and G. D. Collins, Cornell University, *national vice-president.* The formal installation was followed by a dinner at the University Inn, in honor of the installing officers, visiting members of Sigma Pi Sigma and administrative officers of the university. After brief speeches by Dr. Royal A. Porter, head of the physics department at Syracuse, and others, Dr. White delivered an address on "New Frontiers in Contemporary Physics."

THE Textile Foundation has authorized a survey into the personnel and facilities for textile education. A committee consisting of Dr. Karl T. Compton, president of Massachusetts Institute of Technology, E. C. Brooks, president of North Carolina State College, and R. E. Doherty, dean of the School of Engineering, Yale University, has been appointed to inquire into the possibility of such a survey, and upon their recommendation the work will begin.

THE appointment of an advisory committee on sanitation to serve the Baltimore Health Department, especially on matters of environmental hygiene, has been announced. Dr. William H. Howell, director emeritus of the Johns Hopkins School of Hygiene and Public Health, is chairman of the committee. Wilmer H. Schulze, who since 1929 has been chief of the division of chemical technology, was made director of the new bureau of environmental hygiene in the health department.

DR. GLENNON GILBOY, associate professor of soil mechanics in the department of civil engineering at the Massachusetts Institute of Technology, has sailed for Copenhagen, where he will attend the sessions of the World Power Conference as a delegate of the United States. The conference opened in Copenhagen on June 26, continues in Stockholm from June 28 to July 6 and will end in Oslo on July 8.

COLONEL CHARLES F. CRAIG, of the Department of Tropical Medicine, Tulane University, spoke on "The Factors Influencing the Transmission of the Malarial Fevers" at the recent meeting of the New Orleans Academy of Science.

AFTER completing a series of lectures at the University of London in May, Professor William K. Gregory gave a lecture on June 6 at the University of Oxford on "The Evolution of Jaws and Teeth in Primates." Dr. Gregory has now returned to the United States.

THE annual Boyle lecture of the Junior Scientific Club at the University of Oxford was delivered on June 2 by Lord Rutherford, who took as his subject "The Artificial Transmutation of the Elements."

THE fifth congress of the International Society of Urology will be held at the Royal Society of Medicine, London, from July 10 to 15, under the presidency of Sir John Thomson-Walker.

THE fifteenth annual meeting of the American Society of Mammalogists was held at the Biological Institute of Harvard University, from May 9 to May 13. Sixty-six members were present from ten states and one Canadian province. Forty-one papers were presented. Several resolutions were passed, among them one urging that the black bear be taken off of the bounty list in New Hampshire, and another stressing the importance of preserving the elk herd in the Olympic Mountains. The officers elected for the coming year were: *President,* Vernon Bailey; *Vice-presidents,* T. S. Palmer, H. E. Anthony; *Recording Secretary,* Robert K. Enders; *Corresponding Secretary,* Robert T. Hatt; *Treasurer,* Mrs. Viola S. Snyder; *Directors,* class of 1933–1935, Joseph Grinnell, A. Brazier Howell, Remington Kellogg, W. E. Saunders, Harold Coolidge, Jr. Edward A. Preble continues as chairman of the editorial board in charge of *The Journal of Mammalogy.* The next annual meeting will be held at the American Museum of Natural History in New York City.

THE United States Civil Service Commission has announced open competitive examinations for the positions of senior highway construction supervisor, salary $4,600 to $5,400; senior highway design engineer, salary $4,600 to $5,400, both with the Bureau of Public Roads, Department of Agriculture, Washington, D. C.; junior park naturalist, Department of the Interior, salary $2,000 a year. The salaries carry a provision for a 15 per cent. reduction as a measure of economy and a 3½ per cent. deduction for retirement.

MORE than $2,000,000 has been bequeathed to the University of Chicago by the late W. G. Zoller to establish and maintain a free dental dispensary, according to the Chicago *Tribune.* The income will be used by the university "for the purpose of equipping and maintaining dispensaries and laboratories and to supply competent and skilful dental service, including diagnostic aids to the needy and poor, free of charge, in such manner that the greatest number of people may secure skilful treatment to enable them to be relieved, and to prevent the numerous ills which result from neglect of the teeth."

WE learn from the *Journal* of the American Medical Association that ceremonies were held on April 21 dedicating the George Eastman Dental Clinic at Rome, a gift to the Italian government from the late

Mr. Eastman, of Rochester, New York. Harvey J. Burkhart, D.D.S., director of the Rochester Dental Dispensary, founded by Mr. Eastman, formally presented the building to the government and Dr. Amedeo Perna, director of the new institution, accepted it. A bust of Mr. Eastman, presented to the clinic by Italian citizens of Rochester, was unveiled by Mrs. Burkhart, following an address by Dr. Joseph Carlucci, Rochester. The Honorable John W. Garrett, ambassador from the United States to Italy, read a cable of congratulation from President Roosevelt. Premier Mussolini inspected the building during the day. The Rome clinic is the second of five dental clinics in European cities for which Mr. Eastman set aside gifts of $1,000,000 each. The first was opened in London two years ago. The corner-stone for the third, in Stockholm, was laid on April 29, at ceremonies in which the crown prince and princess of Sweden and Dr. and Mrs. Burkhart participated. It is expected that this clinic will be finished by September, 1934, and that the corner-stones for similar buildings in Paris and Brussels will be laid this autumn.

THE *Journal* of the American Medical Association reports that the All-India Institute of Hygiene and Public Health, Calcutta, a gift of the Rockefeller Foundation to the government of India, was opened recently; addresses were made by Sir John Anderson, governor of Bengal, and Lieut. Col. Alexander D. Stewart, director of the institute. The school will be operated in cooperation with the Calcutta School of Tropical Medicine, where basic subjects will continue to be taught, while the institute deals purely with public health subjects related to Indian requirements. It will later be affiliated with the University of Calcutta, through which a doctorate in public health will be offered. The building, which harmonizes with the school of tropical medicine, has four stories, with facilities for teaching, laboratory work and lectures. A number of rooms will be artificially cooled.

THE Franklin Institute of Philadelphia, on May 17, 1933, conferred a John Price Wetherill Medal on The Koppers Co., Pittsburgh, "in consideration of the development of systems for the liquid purification of gases, the success of which is evidenced by the number of such installations in regular use." The Koppers Research Department, working at the Mellon Institute and at the company's plants, developed a purification process using a liquid absorber. In this process the hydrogen sulfide is first absorbed, and then removed from the absorbing solution by activation with air. This air, containing the hydrogen sulfide, is either discharged into the atmosphere or utilized through combustion in boilers, gas producers, or coke ovens. Later modifications were made in the process whereby sulfur could be recovered from the hydrogen sulfide.

ACCORDING to press reports Colonel Charles A. Lindbergh, technical adviser to the Pan-American Airways System, may take charge of survey flying in Greenland and Iceland this summer. Juan T. Trippe, president of the system, states that an expedition would carry on further studies of the northern transatlantic flying route. If it is possible for him to be away, Colonel Lindbergh may later join the expedition by plane. A chartered vessel, the *S. S. Jelling,* of 3,500 tons, will carry a technical staff headed by Major Robert A. Logan, of the airline, to Labrador and Greenland. It will have on board equipment for meteorological study, including an airplane. The vessel will also serve as a base for the expedition. The expedition aims to supplement the data on the route already assembled. The work is being carried on in association with European international airlines, including Imperial Airways and the French Aéropostale. It is planned that an airplane, flying from New York, shall join the expedition later in the summer to carry out special surveys and photographic work.

DISCUSSION

A GRAND MASTER KEY TO BIOLOGICAL LITERATURE

BIOLOGY long since has grown to unwieldy proportions and has split into several groups of more workable size and presumably of greater community of interest. These groups in turn have undergone or are undergoing a disintegration. At Atlantic City, for example, was held the first annual meeting of the Genetics Society of America with a program of 45 papers. A new Mycological Society of America emerged at the same time. Under the four headings of Agriculture, Botany, Medical Sciences and Zoology, 19 organizations held meetings at Atlantic City and in most of them simultaneous sessions were held to dispose of the mass of papers offered. Furthermore, the Atlantic City meeting was not one of the "big" meetings, and many societies met elsewhere. Truly biology has spawned a diversified progeny and the end is not yet.

Some of the new organizations indicate clearly the need for realignments—the old cleavage lines are now unnatural. This was recognized 18 years ago by the Ecologists and more than a year ago by the Geneticists. In other cases the need is extant, witness simultaneous sessions dealing with virus diseases in the Medical Sciences and in the Phytopathological Society, not to mention papers in three different societies dealing with problems of immunity.

The literature of biology is a relatively permanent thing. It will be extant long after the scientist and his presentation at the "annual meeting" are gone and all but forgotten. This literature unfortunately appears in a much greater variety of places than the fairly large number of societies would indicate, even after multiplying that number by the number of nations in which scholarly work is being done. In fact, over 5,000 serial publications are examined for biological publications by the corps of workers of *Biological Abstracts*. Little wonder that a worker in some narrow field of biology hesitates to comment on biology in general or on work in some other cubicle of the science. For some of these cubicles workable keys to the literature exist, but for some others there is no key or the keys have become rusty or are either temporarily misplaced or perhaps lost. Biologists have not been unmindful of the confusion that exists and for several years past have been trying to do something to improve the situation. The monthly accretions of *Biological Abstracts* only serve to intensify and emphasize the necessity for a grand master key. Most fortunately it now appears that the key is going to be available to any one who wishes it. Dr. McClung's modest announcement in SCIENCE of May 27, 1932, indicated that support had been found for the publication of indexes, and the appearance of the index for volume 2 of *Biological Abstracts* in December with the promise of an index for volume 3 within a few months is tangible evidence that this most important need of biology is going to be met.

Ordinarily an index volume can be inserted at its proper place in a file to be examined when needed. A volume which is to form a part of the grand master key to recent biological literature is worth examining most critically. Is it really going to work? The undersigned, of course, can apply the test only in a limited way, but it is easy to see that the index to the biological literature of the year 1928 makes a volume of nearly 500 pages, pages the same size as the one on which these words are printed, six point type, the first quarter with four columns to the page and the remaining three quarters with three columns to the page. Truly, there are a large number of references here, an almost unbelievably large number, but in the very first line the consultant is reminded that "this volume covers only a part of the literature published in the period during which the volume was issued. Succeeding volumes . . . must be consulted. . . ." As one reads on for four pages it becomes evident that the compilers of the volume are biologists, that they speak in terms readily understood by their coworkers, that the problems of making a useful index have been studied most carefully. Upon glancing through the four pages of "introductory guide to the indexes" it becomes apparent that they are pages to be read again. One needs to understand exactly what is said here in order to appreciate how ambitious is the pretension of these index makers. It sounds almost too good to be true. Even the mechanics of construction and composition of such a table will arouse the curiosity of the editorially minded.

But the proof of the genuineness of this master key lies in the actual tests. Does it actually turn the lock of this cubicle and that? The writer has made some tests in a field with which he is familiar. Of course, an author index is largely a matter of alphabet, but in this index each joint or junior author rates a full entry with his name in boldface type. The most notable thing about the subject index is the fact that the words in common usage by workers appear there in proper alphabetic sequence. There is no necessity to speculate about the system of logic employed by the compilers. Generous use is made of "see also" and "see under." The Systematist doubtless will be pleased with the separate systematic index, but this index is also made useful to those who are only mildly concerned with systematics. Each generic name in the subject index is set in italics and is followed by a reference to the systematic index. By turning to the systematic index one is able to orient himself quickly, and he can find there the names of organisms in closely related genera. Furthermore, there is a geographical index and a geological index to paleontological material. By a judicious and intelligent use of the whole index it is possible to cull out from the index alone the papers that might have interest. The abstracts may be consulted then to find out more about the original papers.

It is to be noted that the subject index is based upon an analysis of the abstract and not merely the title. The master key goes no farther than the abstract, but there is increasing evidence that the title "grand master key" is about to be justified. The number of abstracts prepared by the authors themselves appears to be increasing from volume to volume and what is even more important the quality of the abstract is positively improving. Collaborators are learning by experience how to prepare the most useful kind of abstract. In one test case pursued by the writer it was found that an author abstract was actually more useful than the original paper. The original is a long, intricate account of experiments and deductions. The abstract is a short concise statement of results prepared by an author in whose accuracy and integrity a personal acquaintance, at least, places absolute confidence. This suggests, incidentally, that if a limitation of space had been imposed by the editor of the research journal a more

readable original might have resulted. Biologists generally are most assuredly under great obligation to the editors who are constructing this grand master key to our literature, and especially are they indebted to the Rockefeller Foundation, which through its support is making this fine work possible. It is indeed encouraging that a great foundation recognizes the fundamental importance of such instruments in the progress of science, especially with the increasing complexity of the literature, and is facilitating their development through a broad program of support. Few opportunities present themselves where limited funds accomplish so much for the general welfare of the science.

DONALD REDDICK

CORNELL UNIVERSITY

SWARMING AND MATING OF ANTS

VARIOUS kinds of ants are present on lawns in Columbia, Missouri, including large black and brown forms measuring about 1 cm in length and the smaller ones 2 to 5 mm. For 30 years it has been observed that they swarm between August 15 and 20 each year, the average date being near the 20th. This usually takes place about 4 o'clock in the afternoon and it has frequently happened that the swarming has occurred following rain the previous night or forenoon. All varieties swarm at this time, and the start, heralded by the expulsion of the queens to the surface of the ground, is remarkably simultaneous between the different colonies. Once started, within the space of a few minutes, the surface of the ground for a foot or more surrounding the comparatively inconspicuous nest, as judged by the entrance or chimney, is occupied by scores or hundreds of queens, each queen being in charge of several workers who groom her for her flight. Intermingled with the queens and workers are many male ants nervously darting about. Soon after the first queens are expelled from the chimney by workers pushing and pulling—the grooming process is completed and she takes wing. Likewise the male ants take wing. At varying distances the queens alight, as do also the males, but no individual queen is followed by males. After alighting the queen mounts some object as a blade of grass where she is found by a male and the mating process is accomplished in a minute or two and the male departs. After a short interval of quiescence the female becomes nervously active and in a minute or two while clinging to a blade of grass or similar object—by means of her legs she detaches her wings. Immediately she descends to the ground and rapidly searches for a place to begin burrowing. In the average case this is accomplished in a very short time and she starts a tunnel for a new colony. In size the male is much smaller, while the queens are many times larger than the ordinary worker.

Last August while observing a small colony of small brown ants possessing not more than a dozen queens, which had just been removed to the surface and were being groomed for flight, a large black worker ant joined the group—whether by accident or design not being apparent—and instantly a remarkable change in the colony's activities occurred. The queens instantly were seized by several workers and rushed underground, while a mob of other workers attacked the intruder, literally overwhelming it, almost concealing its body. Within less than a minute it was stretched flat with the earth—each appendage, as the limbs, being grasped near the end by an ant which in turn was grasped posteriorly by another ant which in turn was similarly grasped by another ant, so that each limb was stretched by three or more ants which formed radiating lines from the victim's body. Within another minute apparently the victim was dead or rendered harmless, for all but two or three workers abandoned the carcass and retired to the colony, which at this time showed little evidences of activity, the only inhabitants on the surface being the two or three workers engaged in dragging the carcass to the entrance of the colony. The episode was a miniature, but thrilling enactment, with exaggerated ferocity, of Gulliver's experience in Lilliput.

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GOITER PREVENTION WITH FOOD PLANTS GROWN ON IODIZED SOIL

BEAUMONT and Karns[1] have recently published analyses indicating that the iodine content of turnips can be increased by the application of potassium iodide to the soil. "The iodide-treated plants contained 441 and 950 parts per billion of iodine in the roots and tops, respectively, against 165 and 441 parts in chloride-treated plots."

In connection with this "large relative increase in iodine content" the authors raise the question as to "whether these quantities of iodine in food have therapeutic value."

The answer to this question is of considerable practical interest, in view of the well-recognized pathologic changes in the thyroid gland dependent upon a deficiency of iodine in the soil of certain rather extensive regions of the United States sometimes called the "goiter zones."

A significant contribution concerning the prophylactic value of iodide fertilization of the soil is the extensive study carried on by H. Hunziker,[2] in Swit-

[1] A. B. Beaumont and Geo. M. Karns, SCIENCE, 76: 567, 1932.

[2] H. Hunziker, *Schweiz. Woch'schr.*, 45: 2, 1920.

zerland, a country where thyroid pathology constitutes a national problem.

In a preliminary field experiment Hunziker determined (1916) that application of a small amount of iodide of potassium to the soil did not affect the yield of grass unfavorably.

During the following 3 years (1917 to 1919 inclusive) iodide of potassium was added to the fertilizer used for the garden from which Dr. Hunziker's family was supplied with such vegetables as spinach, rhubarb, cabbage, lettuce, beans, etc. (In 1918 the amount of KI applied to the soil was 17 grams to 1,200 square-meters; in 1919 about 20 grams to the same area.) The iodized vegetables were served to his 5 children (2 boys, 3 girls) ranging in age, at the beginning of the experiment, from 3 to 8 years.

As a control 5 children (2 boys, 3 girls, from 7 to 12 years old) from another family were supplied with vegetables raised on soil which was not iodized.

Hunziker's graphs of the measurements of the circumference of the neck in the thyroid region show plainly the influence of the iodized vegetables on the growth of the thyroid gland. (For the exact mode of the measurements and for the construction of the graph I refer the reader to Hunziker's publication.[2])

The effect of the iodine deficiency of the food was so decided that in July, 1919, after the experiment had lasted 2½ years, the oldest girl of the non-iodized food-group asked that she be treated for a rapidly enlarging struma.

Hunziker's results are corroborated by the findings of von Fellenberg,[3] in Switzerland, and of McClendon and Hathaway,[4] in the United States. According to these authors the development of goiter may be prevented in goitrous zones by administering food-plants raised in goiter-free regions.

Hunziker did not determine the amount of iodine in his vegetables which prevented goiter formation in his children, but McClendon and Hathaway state that 1 part of sodium iodide in 100,000,000 parts of water suffices for this purpose.

It is of historic interest in this connection that in 1850 a commission appointed by the Academy of Science in Paris refused to concur in A. Chatin's[5] conclusion that deficiency of 1/400 milligram of iodine *pro die* might result in goiter development.

I would like to add that Dr. Hunziker carries on his investigations of the goiter problem, while engaged in an active and arduous medical practise in a small country town. Fifteen publications dealing with various aspects of the problem attest his zeal.

[3] von Fellenberg, *Biochem. Ztschr.*, 142: 246, 1923.
[4] McClendon and Hathaway, *Jour. Am. Med. Assn.*, 82: 1668, 1924.
[5] A. Chatin, *Compt. rend. Academ. d. Sciences*, 30: 82, 1850.

Being on the subject of iodized alimentation (under which heading I include the ingestion of the condiment, iodized salt) I take occasion to mention an observation gathered in the field of my specialistic medical endeavor, that is to say, dermatology. I refer to the phenomenon that, due to an existing idiosyncrasy or a developing sensitization (allergy?), the administration of even such minute quantities of iodine as are needed for goiter prophylaxis may be followed, in certain individuals, by a follicular eruption of pustular character. Etiologically, these cutaneous lesions must be differentiated from the juvenile form of acne, which they resemble. Iodide acne seems to occur more frequently since our drinking water is chlorinated, a circumstance which is not surprising, as all the halogens act as follicular irritants ("poisons des follicules," according to Thibierge).

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A BACTERIAL GALL DISEASE OF THE DOUGLAS FIR

A GALL disease of the twigs and stems of the Douglas Fir (*Pseudotsuga taxifolia* Doug.) has been observed quite commonly in parts of Napa, Lake, Santa Cruz, Amador and Siskiyou Counties in California, in marginal localities for the growth of this tree. Infection apparently takes place only on younger trees (about 3 to 15 years old), more abundantly in stands of thrifty, crowded and shaded reproduction. Galls once started on the main stem may continue to live and increase in size for many years. Young trees are sometimes killed by the disease or may have dead tops (spike top) due to girdling by a gall.

The galls are globular in shape, varying in size from a pin head to several inches in diameter, with a rough, spongy, fissured surface breaking out in typical, more or less cross-shaped patterns. The gall is composed of hypertrophied tissues, involving both stele and cortex, and is very similar in structure to the olive tree galls produced by the bacterial pathogene *Bacterium savastanoi* E. F. S.

The causal organism occurs in and among the hypertrophied gall cells and is very easily isolated in pure cultures. It is a non-motile rod averaging $1.9–3.9 \times 0.5–1.5\ \mu$, frequently occurring in pairs. The colony is white with a metallic sheen, rather smooth surface and undulate margin.

Inoculation of the twigs of Douglas Fir trees with this organism gave rise to typical galls from which the organism was again isolated.

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QUOTATIONS

ACADEMIC ASSISTANCE

UNDER the name of the Academic Assistance Council a number of men and women of high distinction have banded themselves together in the interest of those university teachers on the Continent of Europe who have lately been deprived, on political grounds, of their posts and their livelihood. The appeal addresses itself to an ancient and justly cherished English tradition of tolerance. We are accustomed in this country to trust the free working of the intellect. We may claim that our trust is based, not on any underestimate of the disruptive power of thought, but upon a faith in the essential soundness of our own institutions, sufficient to be willing to submit them to the severest of tests without fear that anything will be dissolved away but that which is superfluous, unworthy or outworn. That confidence comes only to a society that has driven its roots very deep into history; and the builders of self-consciously new polities do not possess it. Hence it comes that every revolution makes martyrs in the homes of thought. This is no question of the rightness or wrongness of a political creed. Bolshevist, Fascist, Nazi—all alike have sent professors into exile. The claim of all these exiles upon the hospitality of Englishmen is in every case the same—not the claim of the anti-Bolshevist or the anti-Nazi, but simply that of the seeker after truth.

The immediate need that the Academic Assistance Council seeks to meet is of course that of the refugees from the present régime in Germany. The council has collected a long list of names. Many, but by no means all, are the names of Jewish scholars. That is clearly of importance to Herr Hitler; it is of none whatever to Englishmen. Here we are not concerned with whether a professor is Jew or Gentile, but whether he is to be bond or free—subservient to opinions imposed from above, or claiming the right of learning to follow whithersoever the argument may lead. In vindicating that essential liberty of the mind it is to be hoped that Great Britain will always be ready, not only with applause, but with the material help that is its corollary. British universities will no doubt be swift to offer harborage to our guests in such forms as will enable them to carry on their learned vocations. But universities are for the most part but inadequately endowed even for their own necessities. Reverence for "humaner letters" is not confined to the ranks of professional scholarship, and all who feel that sentiment should respond to the appeal now made. This is not unproductive "charity." It has been the experience of history that the persecution of learning has been the occasion of its special flourishing in the lands that have given it sanctuary. The Byzantine scholars dispersed by the Turks in 1453 sowed the seeds of the Renaissance in Western Europe, and thus repaid a hundredfold the patrons who befriended them. In some such manner we may expect value to be returned for the money which it is now proposed to collect.—*The London Times*.

REPORTS

FIELD CONFERENCE OF PENNSYLVANIA GEOLOGISTS

THE third annual meeting of the Field Conference of Pennsylvania Geologists was held at Harrisburg, Pennsylvania, over the week-end of May 27, 28 and 29. The total attendance of about sixty members and guests included, besides Pennsylvanians, representatives of the profession from Maryland, New Jersey, New York, Virginia and West Virginia. The Pennsylvania Topographic and Geologic Survey was host to the conference. The entire staff, consisting of George H. Ashley, *chairman,* Stanley H. Cathcart, Charles K. Graeber, William O. Hickok, IV, Forrest T. Moyer, Marchant N. Shaffner, Ralph W. Stone and Bradford Willard, *secretary,* served as the local committee and planned and carried out the two and one-half day program, a brief summary of which follows.

Those who arrived by Saturday noon, May 27, were given a choice of three trips. The first, under Mr. Graeber, went to the Cornwall iron mines and spent the afternoon there collecting minerals and studying the geology of this historic mining center. Dr. Hickok led a second trip, whose members, after a shorter visit to Cornwall, saw some of the Triassic igneous and sedimentary rocks near-by and certain metamorphic phases caused by Triassic igneous intrusions of the Triassic sediments and Lower Paleozoics. This trip concluded with a visit to the once famous but now abandoned brownstone quarries at Hummelstown. The third Saturday afternoon trip was in charge of Dr. Ashley. This party climbed Third Mountain about ten miles north of Harrisburg to see the overturned syncline of Pottsville conglomerate there exposed as the western tip of the Southern Anthracite Coal Field. This party also

observed important physiographic features of the Susquehanna Valley region with particular reference to peneplanation.

On Sunday, May 28, the whole conference united for a sixty-five mile tour of the Susquehanna and Juniata valleys. Dr. Willard was in charge of this excursion. The entire Paleozoic column from the Middle Ordovician through complete Silurian and Devonian exposures up to and including the Upper Mississippian was seen, Appalachian structures were observed, stratigraphic problems discussed and fossiliferous localities visited. Dr. Ashley drew the attention of the party to points of physiographic interest and to the river terraces and gravels of Pleistocene or Recent ages. This trip covered in a more extended form the Middle and Upper Paleozoic section to be visited by the International Geological Congress next July on Trip 1–B.

A choice of two trips was offered on Monday, May 29. Mr. Stone and Dr. Hickok led a party through portions of Cumberland and Adams counties where the chief interests were in economic geology including tile and ornamental stone works. Much also was seen of the Precambrian complex of South Mountain, and visits were made to certain ancient iron mines long since in disuse. Simultaneously with the foregoing, Dr. Willard conducted a second trip on Monday. Observations on this tour dealt entirely with stratigraphic problems. Those selecting this excursion visited several Silurian sections in Perry County, paying particular attention to the Ordovician-Silurian relations observable at points along Blue Mountain. The presence of Dr. Frank M. Swartz, of Pennsylvania State College, added greatly to the interest of the trip because of his thorough knowledge of the problems of the Silurian and the Helderberg, which he discussed at a number of localities.

The annual dinner was held at the Hotel Harrisburger on Saturday evening. After the meal, followed a discussion of the local geology by members of the Survey staff. On Sunday evening informal gatherings took place at the residences of Dr. Ashley and Mr. Stone. During a brief business session after the dinner an invitation was extended to the conference from its members residing in or near Pittsburgh to visit that area a year hence. The invitation was accepted by unanimous vote. The date for this meeting is tentatively set for the last week-end in May, 1934.

BRADFORD WILLARD
Secretary-Treasurer

SCIENTIFIC APPARATUS AND LABORATORY METHODS

A SIMPLE STRING ELECTROSCOPE

THE instrument described below was developed while the authors were making a study of certain transient electrical phenomena. While there are instruments in use that are similar in general to this one, its simplicity and ease of manipulation, together with its general adaptability, seem to make a short account of it worth while.

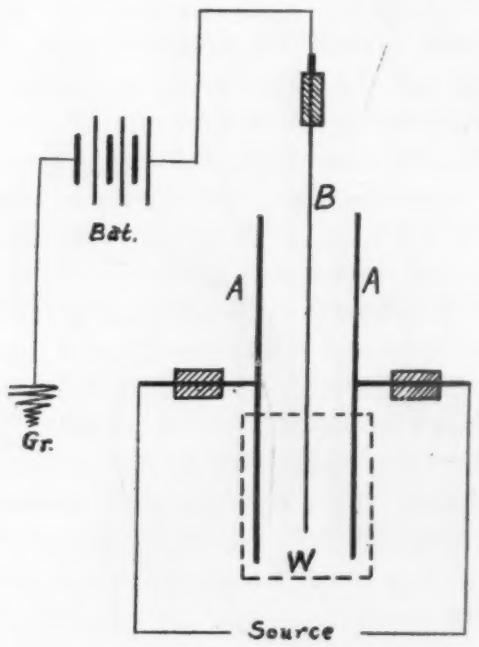

FIG. 1

A A in Fig. 1 are parallel brass plates about 8 cm long and 4 cm wide. They are mounted in the case of the instrument by the projecting rods as shown, so that the distance between them may be adjusted. These rods are supported by insulators of cast sulfur,[1] so that each plate is insulated from the case.

B is a silvered glass fiber[2] approximately 12 cm long hung midway between the plates from another sulfur insulator. It will be noted that the bottom end of the fiber is free.

W is a window in the case of the instrument through which the fiber may be viewed or its image projected.

In visual work the fiber may be observed through a low-powered microscope with a scale in the eyepiece. If the window is illuminated by a small arc, a sharp shadow of the fiber on a bright field may be projected

[1] Cast sulfur has proven to be excellent for this work. It is inexpensive and easily shaped and its insulating value is high. It deteriorates with age, and insulators made from it should be recast at intervals of 6 months or a year.

[2] The use of glass fibers has been surprisingly satisfactory. They are easily and quickly made and they last in service indefinitely.

by means of a cylindrical lens, on a slit in front of a drum carrying a sensitized film. As the drum rotates the film behind the slit is blackened, except where it is protected by the shadow of the fiber. Thus a record of the motion of the fiber may be made in the usual way.

This instrument may be used as a voltmeter and as an oscillograph.

(1) When used as a voltmeter for constant differences of potential the fiber may be connected to a dry cell battery of perhaps 200 volts, and the plates to the source to be measured.

When so connected (Fig. 1) the sensitivity may be varied by changing the distance between the plates and by changing the potential on the fiber. Fig. 2

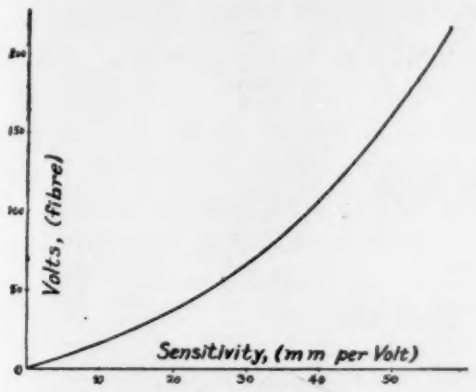

FIG. 2

is a typical curve showing the relation between sensitivity in mm of deflection per volt and fiber potential in volts. The sensitivity through a wide range is very evenly proportional to the potential gradient of the field between the plates. With properly chosen fibers the sensitivity may range from 200 or more mm per volt on the plates to 10 volts per mm, and it may be accurately controlled.

If, instead of connecting the fiber to a battery of dry cells, the fiber is connected through a resistance to one of the plates, the instrument will give steady deflections for alternating differences of potential. When used on differences of potential of this sort, it is very sensitive and readings may be repeated with accuracy.

The fiber should be drawn from ordinary sodium glass tubing and silvered. Its diameter should be something like .2 mm and for voltmeter work should be uniform throughout the whole length. The fact that it is a hollow cylinder insures high elasticity and small inertia, and these properties give high damping in ordinary air and a short period to the moving member. Fibers of this sort usually come to rest at the position of maximum steady deflection in less than .1 second.

(2) When used as an oscillograph a differently shaped fiber is required.

If the instrument as described above is used on alternating differences of potential with the uniform fiber charged from the battery as in Fig. 1, it is easily possible to set up nodes and loops like those in a vibrating rod in the fiber. While not useful in this condition for the study of wave forms, it is very good for the study of vibrations of rods and the like. It lends itself nicely to projection before a class, and when used with a stroboscope it shows the vibrations of the fiber clearly and distinctly in detail.

If the fiber is drawn so as to taper from a reasonable thickness (perhaps .5 mm) at the upper end to hair-like thinness at the free lower end, the stiffer upper part will not vibrate, but the lower fourth or thereabouts will, because of its extreme lightness, follow the variations of the field with no period of its own.

In this condition the fiber will follow audio frequency waves with fidelity when the plates are connected across a source. In connection with a microphone and a one-stage amplifier, voice currents, etc., may be recorded with great nicety. Records have been made of complex waves from various sources, such as organ pipes, orchestral music through the radio, the human voice, etc.

Since the moving part of this instrument is very small and light its motion in the field between the parallel plates disturbs the uniformity of the field very little. Therefore the source of the potential under measurement has to supply a very small charging current to the plates, and consequently very little energy. The exceedingly small amount of energy required to operate the instrument makes it useful in work where the source under investigation is very weak.

Because of the fact that its current requirement is so small, the authors have spoken of the instrument somewhat loosely as an "electrostatic oscillograph."

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SPECIAL ARTICLES

EFFECT OF INHIBITING FACTOR FROM NORMAL TISSUES ON SPONTANEOUS TUMORS OF MICE

IN a previous communication evidence was presented which indicated that a factor or substance could be extracted from mouse placenta and embryo skin which had a definite inhibiting action on the growth of transplanted mouse carcinoma. It has also been shown that an inhibiting factor isolated from a fowl sarcoma which was capable of neutralizing the causa-

tive agent of this tumor also inhibited the growth of transplantable mouse sarcoma. It was suggested that these factors were related to the substances which control the growth tendency of normal cells. The present report is an account of the effect of the normal tissue factor on the spontaneous mouse tumors.

Material: The animals used in the tests all came from inbred families of mice with high mammary cancer rates. The source of the inhibitors tested was late term mouse placenta and the skin of embryos of the same period. The tissues were finely minced, spread in a thin layer and dried *in vacuo* at sub-zero temperature. After desiccation was complete the material was powdered, thoroughly extracted with water (0.1 gm to 1 cc) and the larger particles removed by centrifugation.

Group I: This series was made up of 59 mice having a total of 85 primary mammary tumors, which were classed as medium to large size. The tumors were removed by operation and the operated field washed with embryo skin or placenta extract. In 57 of the animals, two grafts were taken from the removed tumor, one immersed in the test fluid and the other in Ringer's solution, and then both were inoculated into the mouse from which the tumor had been removed. Only those animals living over five weeks after the operation are included in the following table. For controls tumor mice from the same families were operated on and grafts returned without treatment to the field of operation or to the tumor grafted to another site.

TABLE I

FATE OF AUTOGRAFTS

	Grew Per cent.	Doubtful or no growth Per cent.
20 tumors removed:		
Autografts treated with embryo skin extract	50.0	50.0
Autografts not treated	75.0	25.0
37 tumors removed:		
Autografts treated with placenta extract	21.6	78.4
Autografts not treated	78.4	21.6
64 tumors removed:		
Autografts, no treatment to graft or wound	96.9	3.1

LOCAL RECURRENCE FOLLOWING OPERATION

		Per cent.
27 treated with skin extract	3 recurrences	11.1
58 treated with placenta extract	3 recurrences	5.2
89 with no treatment	44 recurrences	49.4

Judged by the marked reduction in local recurrences and the large number of treated autografts which failed to grow the results seem definite. The average length of life is sometimes over 80 days with 18.6 per cent. still living. There is a suggestion in the above table of some generalized action of the inhibitors in that the untreated autografts grew less well in animals which had received a certain amount of the inhibitor in the operated wound and with the treated graft (75 and 78.4 per cent.) than the autografts in animals receiving no treatment (96.9 per cent.). It is of interest to note that in a control series 32 per cent. of the 50 mice developed new primary tumors, while in the treated group only 4, or 6.8 per cent., had new tumors.

Group II: The more crucial test of the inhibiting action would be its effect on the spontaneous tumor undisturbed by operative procedure. To eliminate any possible local interference with blood supply to the tumors the injections of the test fluids were made intraperitoneally at weekly intervals. The group includes 91 mice with 127 well-established primary tumors, all from inbred stocks with high mammary cancer rates. Of these 40 were treated with embryo skin extract and 51 with placenta extract. The average size of these tumors was somewhat smaller than those used in the operated series. The results are given in Table II.

TABLE II

					Per cent.
Number of tumors in mice treated with embryo skin extract	60				
Continued growth	20				33.3
Stationary or slight retrogression	17	28.3	Per	cent.	66.7
Marked retrogression	7	11.7	"	"	
Complete absorption	16	26.7	"	"	
Number of tumors in mice treated with placenta extract	67				
Continued growth	21				31.3
Stationary or slight retrogression	16	23.9	Per	cent.	68.7
Marked retrogression	17	25.4	"	"	
Complete absorption	13	19.4	"	"	

The figures given above, where only 33.3 per cent. of the tumors in one series and 31.3 per cent. in the other continued to grow after treatment was started, may be compared with our experience with hundreds of untreated tumor animals from the same stocks followed in this laboratory. Steady, progressive growth is the rule, with temporary cessation of growth or retrogression a rare occurrence, and the absorption of an established tumor of such unusual occurrence as to require no consideration in the analysis of the above figures. The average time the treated animals have been under observation has been about 60 days, with a number still living.

There seems to be little doubt that the extracts of the two tissues which have previously been shown to reduce the takes of transplanted cancer have an influence on natural or spontaneous cancer. This inhibiting action is evident not only on the local post-operative recurrence, and the growth of autografts where there was direct contact between the extracts and the cancer cells, but is observable likewise on untreated or unoperated tumors at a distance when the inhibiting materials were injected into the peritoneal cavity.

We do not consider that the results stated necessarily establish the hypothesis on which the experiment was based, for the complexity of the materials makes it quite possible that this explanation is not the correct one. The general relations between the factors which influence the origin and growth of spontaneous tumors, the balancing mechanism of normal tissues, and the inhibitor which has been isolated from the chicken sarcomas can not be seriously discussed until further knowledge is available.

A more detailed report, including data on histological types of the tumors, metastasis occurrence, etc., will be published later. At present the results recorded here are considered of only theoretical importance.

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FUNDAMENTAL LIMITS TO THE SIZES OF CLASTIC GRAINS

TEN years ago the writer presented a scale of size limits for the terms boulder, cobble, pebble, granule and sand, silt and clay grains.[1] The scale was based on average prevailing opinion and stated in units to conform to certain sieve openings in the mechanical analysis scale first used extensively by Udden.[2] With growing precision in terminology and increasing use of quantitative methods of analysis of detrital materials, the usage suggested by the writer has been generally accepted, with only occasional modification of certain terms.

Names for the unconsolidated and consolidated aggregate were also proposed and differ from the fragment names chiefly in the bracketing of the aggregates of boulders, cobbles, pebbles and granules under the single name "gravel." In this usage there is tacit implication that the materials gravel, sand, silt and clay are of equal rank in classification. Aside from purely arbitrary division into classes of equal width on an arithmetic or geometric scale, equality of rank would result only from the use of limits having coordinate natural or genetic significance.

Recently, the writer was led to further consideration of these terms and the conclusion was reached that the seeming narrow unity of the materials sand, silt and clay and the wide size range in the gravel class probably represent an unconscious recognition by man, layman as well as geologist, of certain genetic units based on the several fundamental modes of transport by running water and on several modes of derivation from parent rocks. This interpretation is shown in the following table:

TABLE I

Mode of transport	Usual source	Name of aggregate
Traction	All available hard rocks	Gravel
Inertia suspension	Mono-mineral grains of phanerites (chiefly)	Sand
Viscous suspension	Mono-mineral grains of any rocks (chiefly)	Silt
Colloidal suspension	Molecularly decomposable materials	Clay

In Table I there are listed four distinct modes of handling which occur in running water. Both traction and inertia suspension take place approximately in accordance with the so-called Sixth Power Law, which postulates a complete transfer of kinetic energy from water to particle and which makes no allowance for the subsidiary effect of viscous drag. Viscous suspension, on the other hand, accounts for the transport of finer particles in which the surface effect is greater relative to the mass. The size-velocity relationship in this range is defined by the well-known Stokes Law.[3] Still smaller particles are kept in suspension chiefly by the kinetic effects found in dispersed systems, *i.e.*, colloid systems.

It should, of course, be recognized that none of the lines of demarcation between these modes of transport are sharp and that water-transported detrital materials occur in a continuous series from large boulders to clay particles. However, it appears that each of the processes of transportation has an optimum range in nature and that only partial overlapping occurs. Where more than one of the

[1] C. K. Wentworth, "A Scale of Grade and Class Terms for Clastic Sediments," *Jour. of Geology*, 30: 377–392. 1922.

[2] J. A. Udden, "Mechanical Composition of Clastic Sediments," *Geol. Soc. Amer. Bull.*, 25: 655–744. 1914.

[3] G. G. Stokes, "On the Effect of the Internal Friction of Fluids on the Motion of Pendulums," *Trans. Cambridge Philos. Soc.*, Vol. 9, part 2, pp. 8–106, espec. sec. 4, pp. 48–57, 1851.

processes is carried on concurrently by the same stream, the processes are either found quite distinct in different parts of the stream, or the conditions of flood and tumultuous flow are obviously ill-adapted to effective segregation of the grains by sizes.

If the thesis here implied be correct, the several processes are sufficiently distinct, in spite of overlapping due to variation in velocity, so that detrital materials found in natural deposits occur more abundantly well within the individual coarseness ranges represented by gravel, sand, silt and clay, than in the ranges transitional between those classes. The assumed arrangement of these modes is shown in the figure.

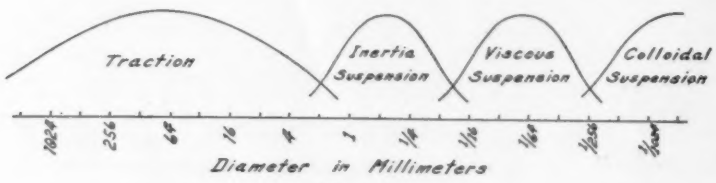

FIG. 1

Column two of Table I suggests a possible further natural contrast of sizes. It is thought that phanerites with grain sizes from ½ mm to 2 or 3 mm are enormously more abundant than similar rocks of coarser grain and that these furnish quartz grains preponderantly in the sand sizes. Among acid rocks, those of finer grain than ½ mm are subordinate to the coarser ones.[4] Aphanitic basic rocks are exposed over far larger outcrop area than coarser basic rocks. Few basic rocks yield mono-mineral grains of sufficient durability to exert any important effect in fixing sand sizes. By far the most important control exerted by the grain size of igneous rocks is due to the predominant sizes of quartz grains in granites.

In the calcareous detrital sediments of certain beaches, the sizes of shells or of other parts of particular species of animals locally give rise to somewhat homogeneous, well-sorted sediments. In particular, one may note the opercula of turbo snails, segments of sea-urchin spines and the tests of foraminifera.[5] These are, of course, much too localized to have been significant in fixing the established concept of sediment grades.

Some may point out that the foregoing discussion is based on the assumption that detrital sedimentary materials have been chiefly sorted by water. The reply is that materials chiefly assembled by other agencies are mostly not readily classifiable in the common terms. For example, glacial till requires a name of its own, the material of kames and eskers deposited by water under somewhat unusual conditions is commonly a somewhat indeterminate mixture of sand and gravel.

Loess, derived perhaps largely from glacial silt and deposited by the wind, does not correspond exactly either with sand or silt or clay. Most soils are also cases in point. Materials accumulated through imperfect action of water are commonly difficult to classify, such as many of the deposits of arid regions and terrace materials deposited by streams excessively flooded by glacial or other waters.

We are forced to recognize that the gravel-sand-silt-clay scale is an aqueous scale and there appears to be a true genetic, even if complex, basis for the grades represented by our common size terms. Wind action may result in superior sorting of sands originally accumulated by aqueous agencies. Whether a well-sorted, well-rounded, mature sand has ever been produced exclusively by the action of wind on the debris from a granite or other suitable rock may well be doubted. If such derivation has taken place, it must be very exceptional and very local.

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along its course. They hug its sides closely, though they take no part in its actual growth process, nor in its function as a nerve. These are known as the "sheath cells." Finally, as the nerve becomes more mature, it develops around itself a layer of fatty material called the "myelin sheath."

All these developments were shown in the motion pictures. In life, the growth process is rather slow, but by taking only one picture in two seconds and then projecting them at normal movie speed of sixteen to the second, the apparent rate of growth was speeded up 32 times. Another portion of the film was taken at the rate of one frame in eight seconds, giving them a speeding-up effect on the screen of 128 times the natural rate.

Growth after injury, as well as normal growth, was studied. It has long been a disputed point whether a severed nerve grew together again or started afresh from the cut end nearest the central nervous system. Evidence apparently supporting both views has been produced in the past. Professor Speidel's studies showed that where the two cut ends apparently grew together again, there was an anastomosis, or anatomical detour, connecting them by another path. A cut end really quite separated from the central nervous system degenerates and disappears and a new nerve fiber grows out to replace it.

Professor Speidel's first studies were conducted by watching the growth of nerve fibers in the transparent tissues of a frog tadpole's tail. During the past year he has also been studying nerve fiber growth in salamanders, which are rather remote zoological cousins of the frogs. He finds that the growth processes in this order of animals are essentially the same as those he observed in the tadpole tails.

GROWTH OF PLANTS STIMULATED BY X-RAYS

X-RAYS can cause plants to grow faster, blossom earlier, form more chlorophyll, and in general speed up their life processes. But if they get too much of a dose of the rays, they become cripples. This in brief summary is what Professor Charles A. Shull, of the University of Chicago, has found in experiments which he reported at Atlantic City before the meeting of the American Society of Plant Physiologists.

Professor Shull exposed corn, wheat, oats and sunflowers to x-rays for periods of from one to five minutes, inclusive, under screens to take out the harmful parts of the x-ray spectrum, and also for ten minutes without the benefit of screening. He compared the growth of these plants with "control" plants that were not x-rayed at all.

All the rayed plants except the ten-minute lot apparently were stimulated by the treatment. In some cases they became juicier, or more succulent, as well as larger. In corn a considerable increase of the green food-making substance, chlorophyll, was noted, running from 20 to 60 per cent. above the controls. X-rayed seeds carried on their respiratory processes with greater energy, the data indicating from 30 to 50 per cent. increase.

The three-minute treatment seemed to be most beneficial especially in the case of the sunflowers. Pots of the young plants ranged side by side mark off a curve with the graduated heights of their tops: good at one minute, best at three, not so good at five, and disastrous for the ten-minute treatment without a screen. The plants were in bud at about the same time, but the three-minute group blossomed first.

The condition of the ten-minute group indicated emphatically the effects of too much of a good thing. It was badly burned, and pocked all over the leaves, as though with a mosaic disease. The leaves were irregularly lopsided, an effect not observed at all in the plants given shorter rayings under screens.

ITEMS

THE earth and the moon were born out of the parent spiral nebula that fathered not only the sun but all the other stars of the Milky Way, is the suggestion of Dr. Harlow Shapley, of Harvard College Observatory, made at the meeting of the American Association for the Advancement of Science. This theory makes the moon, planets and sun all the same age, the progeny of a "secondary swirl or eddy of the parental spiral nebula out of which the local galaxy or Milky Way may be supposed to have generated." The conventional theory is that the earth and planets were born when a passing star pulled matter out of the sun, and some have theorized that the moon was cleaved off the earth at an even later time.

THE planetary nebulae, globes of glowing gas that can be seen in various parts of the sky, are not the light airy things they seem. According to Dr. Adrian van Maanen, of the Mount Wilson Observatory, who reported to the American Astronomical Society, the nuclei of these structures are something like 250 times as massive as the sun, and about a fifth its diameter. This has been found from studies of the motions of these bodies, from which their distances have been determined.

ULTRA-VIOLET rays change the viscosity, or "thickness," of protoplasm by causing it to let go of calcium which it contains. This conclusion is indicated by experiments reported before the American Society of Zoologists by Professor L. V. Heilbrunn and Kathryn Daugherty, of the University of Pennsylvania. They exposed one species of amoeba to the action of ultra-violet radiation. Afterwards they whirled the animals in a centrifuge, which enabled them to measure the changes in their protoplasmic viscosity. They found that the interior protoplasm had been made more viscous, while the originally fairly stiff outer protoplasm had become more fluid. They knew from previous experiments that ultra-violet raying causes a loss of calcium from protoplasm. The changes in the amoebae they ascribed to a release of calcium from the originally stiff, calcium-rich outer layer, which calcium then diffused into the inner mass of protoplasm, originally fluid, causing it to become more viscous.

"We postulate the existence of the gene because of the properties it gives to aggregates of other matter," Drs. Gowen and Gay explained. "Size is a fundamental structural characteristic. The measurement of size, even though it may be crude, has, if we may judge by our sister sciences, always led to further progress."

The Rockefeller investigators based their discovery of the gene's size upon the discovery made several years ago that x-rays will smash into genes and change the bodily characteristics that they transmit. They used the drosophila fruit flies that have been experimented upon to contribute so much to the new knowledge of heredity obtained since the turn of the century. Pure x-rays specially produced were used to bring about the changes in genes that are known as mutations. Thousands of flies were used in the experiments. The magnitude of the average gene was found by dividing the amount of chromatin, or material in the chromosome, by the number of genes estimated by the mutations observed.

The total number of genes in any one cell was shown to be not less than fourteen thousand three hundred eighty. This corresponded to a largest gene size expressed numerically in cubic centimeters as one tenth visualize this extremely small volume, one quintillionth multiplied by itself eighteen times. In attempting to of a cubic centimeter, it may be helpful to remember that a centimeter is a little more than a third of an inch.

These gene size determinations check approximately with those reported several months ago by Professor Oswald Blackwood, of the University of Pittsburgh.—WATSON DAVIS.

KING TUT'S PURPLE GOLD

BEAUTIFUL purple surface films on golden sequins found in the tomb of Tut-Ankh-Amen have been proved to be due to the presence of iron in the gold, by Professor R. W. Wood, of the Johns Hopkins University. Professor Wood reported on his examination of these ancient ornaments before the American Association for the Advancement of Science.

The sequins have been the subject of much discussion ever since they were first discovered. Some investigators have claimed that the Egyptians knew an art for coloring gold surface purple, while others have believed that the purple sheen was a kind of patina due to the great age of the ornaments. Professor Wood, using the methods of a physicist, has shown the color to be due merely to the presence of iron in gold which has been first hammered and then heated. He even made duplicates of the sequins by hammering out a gold-iron alloy into thin flakes and heating the latter over a flame. One of his modern purple-gold sequins has been sent to the Cairo Museum, to be displayed along with the originals.

A modern beauty aid helped in the solution of the riddle of the purple film. Professor Wood found he could remove the film by coating the gold ornaments with celluloid varnish such as is used in fingernail polish, and then peeling off the varnish, leaving the underlying gold of a bright yellow color. There was no sign of the film on the peeled-off varnish layer, but the film could be made to reappear by redepositing gold on the side to which the film was attached by vaporizing gold in a vacuum. Then the purple could again be seen by reflected light. The problem in physical optics presented by this phenomenon is still under examination.

Subjected to spectroscopic examination, the stripped-off film proved to be principally iron, probably an iron oxide. Professor Wood then suspended one of the sequins from which the purple film had been removed between the poles of a strong electromagnet. It was attracted toward one of the poles, demonstrating the presence of iron in the gold.

Etching the surface of the gold with acid showed a very marked crystalline structure, such as is found only when rolled or hammered sheet gold is subsequently heated to nearly a red heat. Microscopic examination showed on the surface numerous small globules of gold standing out in high relief, conclusive evidence that the sequins had been heated to a high temperature after having been hammered into shape. It was after having learned these facts that Professor Wood took gold and iron and duplicated the product of the "lost art" of the ancient Egyptian court jewelers.

The microscopic globules Professor Wood believes to be due to melting of the gold out of a gold-orpiment mixture experimentally tried by the Egyptian artist. Orpiment is a bright yellow arsenic-sulphur compound known to the Egyptians and used by them in tomb wall decorations. Lumps of it were found in Tut-Ankh-Amen's tomb, some of which Professor Wood received from the Cairo authorities.

Melting gold with this orpiment, and rolling the resulting bead out into a plate, Professor Wood heated it over a flame and obtained gold globules exactly like those on the sequins. He also hammered out small nuggets of California gold, which had been in his family since '49, and on heating the resulting plates he again obtained the globules. No purple film appeared, however, for the California gold is free from iron.

MOTION PICTURES OF THE GROWTH OF NERVE FIBERS

MOTION pictures demonstrating how nerve fibers grow through living tissue, and how they repair themselves when injured, were shown before the meeting of the American Association for the Advancement of Science by Professor Carl C. Speidel, of the University of Virginia. Professor Speidel was the winner of the Association's $1,000 prize at the midwinter meeting at New Orleans last year, and the report he rendered constituted a summary of his work up to that time and of advances made since then.

As pictured and explained by Professor Speidel, nerve growth is pioneered by what are known as "growth cones" on the ends of the nerve fibers. These are thickenings of the tips, which probe their way through the tissues, constantly sending out and retracting tiny processes from their surfaces, like finger-tips feeling their way. As the nerve progresses, special cells develop

SCIENCE NEWS

Science Service, Washington, D. C.

COSMIC RAYS

Two of America's leading physicists discussed facts and theories about cosmic rays before the American Association for the Advancement of Science at Atlantic City on December 30.

About most of the experimental facts, they agreed. About the deductions from thousands of experiments performed by scores of investigators ranging the world, they largely disagreed.

Dr. Robert A. Millikan, of the California Institute of Technology, upheld strongly as a fact his conclusion that the cosmic rays that enter the earth's atmosphere are photons, like x-rays and gamma radiation of the same family as light and heat.

Dr. Arthur H. Compton, of the University of Chicago, found "no way of reconciling the data with the hypothesis that any considerable portion of the cosmic rays consists of photons." He concludes that cosmic rays come from outer space as high-speed electrified particles, either negatively charged electrons or positively charged protons.

As to what causes the discharging of the sensitive electrical instruments used in detecting the effects of cosmic radiation, Drs. Compton and Millikan agree. Very energetic electrified particles produce the effect, but whereas Dr. Compton considers them the original rays, Dr. Millikan advanced evidence that they are secondary radiation produced in the earth's air by photons smashing into the hearts of air atoms.

To account for the very penetrating radiations that Dr. Millikan and others have observed in the depths of lakes, Dr. Compton countered with the suggestion that electron cosmic rays produce photons in the earth's atmosphere just as electrons striking an x-ray tube target produce x-rays.

His argument fell in line with experimental evidence for a new process of ionization presented to the same session by Dr. Gordon Locher, a national research fellow at the Bartol Research Foundation, near Philadelphia. According to Dr. Locher x-rays are produced in the gas of a detecting chamber by the passage through of swiftly moving particles like electrons.

Reporting the results of airplane flights this past summer in the United States, Canada and Peru, at altitudes up to twenty-one thousand feet, Dr. Millikan explained that a new type, very sensitive, recording electroscope showed differences in cosmic ray readings at high altitudes that may possibly be explained by a new cause, a modification of the earth's electrical field connected with some secondary influence of sunlight. Changes in the earth's negative electric field such as occur between day and night would change the resistance to the inflow of the secondary negative particles generated by the cosmic rays. But the rays that get down to sea-level are so hard that the earth's electrical field does not affect them. This fits in with a lack of latitude variation in cosmic-ray readings made at sea-level by Dr. Millikan and others recently and in past years.

Dr. Compton and his associates in a world-wide survey during the past eighteen months found large variations with latitude in cosmic ray intensities at sea-level and on the tops of high mountains. This he attributes to the effect of the magnetic field of the earth, since the earth's magnetism would theoretically keep electrified-particle cosmic rays from reaching the equatorial regions where the Compton experiments show cosmic rays to be less.

As to the energies of cosmic rays, there is difference of opinion. Dr. Millikan cited the experiments of his colleague, Dr. Carl D. Anderson, to show that observed cosmic ray energies lie largely below five hundred million volts and that less than a tenth reach the billion volt range.

Dr. Compton advanced an energy of seven billion volts for the electron cosmic rays that are so feeble as not to reach the equator, and he set thirty billion as the figure for a more penetrating component of high-speed electrified particles. Dr. Compton holds that the high energy portion is not affected by the earth's magnetic field.

As to the way in which cosmic-ray effects vary with increase in height over the earth's surface, there is little difference in the experimental results, but both Dr. Millikan and Dr. Compton see the experiments bolstering up their theories.

The question of the origin of the cosmic rays, a moot question upon which there is little experimental evidence except the fact that they come from outer space, was left for future meetings.—WATSON DAVIS.

MEASUREMENT OF UNITS OF HEREDITY

THE unit of heredity known as the gene, that controls physical characteristics and passes them on from generation to generation in man and other living things, has been measured. Its largest size is one quintillionth of a cubic centimeter. This is just about the volume that fifteen protein molecules, one of the largest of the organic chemical aggregations, could crowd into.

This determination of the size limits of the bearers of heredity, announced at Atlantic City to the American Association for the Advancement of Science by Drs. John W. Gowen and E. H. Gay, of the Rockefeller Institute for Medical Research, is considered an important fundamental step in the development of biology.

Genes are the units within the chromosomes which determine the development of physical characteristics when, through the union of male and female germ cells, a new individual is created. Chromosomes can be seen readily with the microscope, but the single gene is probably too small to be seen by the eye even when aided by the most powerful optical means. The gene is as important to biology as molecules, atoms or electrons are to the physical sciences.

SCIENCE NEWS

Science Service, Washington, D. C.

THE AGRICULTURAL APPROPRIATION BILL AND REPRESENTATIVE LAGUARDIA

REPRESENTATIVE Fiorello LaGuardia, Republican lame-duck from New York, has just emerged as one of the most fiery and eloquent defenders of scientific research, in the lower House.

During the debate on the Agricultural Appropriation bill, Representatives Allgood of Alabama, Summers of Washington, Snell of New York, Tabor of Ohio, McGugin of Kansas and others sought to pare or eliminate altogether item after item which would have dealt the scientific work of the department several severe blows.

Due to the masterly defense of Representative LaGuardia and others who joined him in his work, the majority of these amendments to the bill were defeated on the floor.

"Science knows no politics," declaimed the brilliant Italian-American from New York City. "Are we, in the frenzy of economy, brought about by those who control the wealth of this country, seeking to put a barrier on science and research? . . . Science will go on when existing political parties will long have been forgotten."

At another point in the discussions when it seemed that the appropriation for dry land agricultural stations was in danger, Representative LaGuardia defended the past accomplishments of this branch of the Bureau of Plant Industry, and said: "The most humble research scientist in the Department of Agriculture is at this time contributing more to his country than the most useful Member of Congress. The most humble engineer in the General Electric Laboratory or the Radio Corporation of America laboratory is more useful to humanity than the most brilliant orator of this House. The trouble is that the legislative branch of the government has not kept abreast with science. Government has lagged, science has advanced. We have permitted an unbalanced system of distribution to continue while science has increased production. We are living in the paradoxical state where there is great overproduction, on the one hand, and want and misery, on the other. This is not the fault of science. This is the fault of government."

Among the amendments offered by congressmen who saw in the scientific items a place to save money, were:

An attempt to reduce the item for cereal crops and diseases from $488,200 to $465,915; cotton production and diseases from $200,000 to $100,000; foreign plant introduction from $163,574 to $50,000; elimination of the entire amount of $209,955 for forest pathology; genetics and biophysics from $33,617 to $20,000; entire amount for rubber, fiber and other tropical plants, $69,474, because, said Representative Allgood, "This is a subsidy to Ford and other rubber manufacturers"; entire amount of $130,000 for western irrigation agriculture; general administrative expenses in Forestry Service, from $327,819 to $250,000. All these were voted down by the House.

An amendment offered by Representative Summers, of Washington, reducing the $215,000 in the bill for forage crops and diseases to $201,014 was accepted by the House, Summers explaining that the reduction would be applied to work on the corn borer, which he termed the "bogy-man of agriculture."

Other amendments offered and rejected were one to cut Bureau of Chemistry and Soils' Washington appropriation from $1,095,695 to $750,000 (by Allgood, Democrat, of Alabama); another to cut federal highway aid to states from $35,000,000 to $10,000,000.

An amendment accepted by the House was offered by Representative Summers, of Washington, eliminating an item of $25,000 for the development of mechanical equipment for corn borer control by the Bureau of Agricultural Engineering.

Barring slight alterations, however, the bill passed the House, substantially as reported out from the House Appropriations Committee.

SUPPORT OF COLLEGES URGED AT NATIONAL CONFERENCE

BECAUSE of the value of the scientific research being conducted in institutions of higher learning and because of the training they afford for modern complex life, the support of colleges and universities was strongly urged by a special committee of the Citizens Conference on the Crisis in Education, meeting in Washington.

From these institutions has come a large proportion of the trained personnel of the established professions and the leadership of our complex industrial and social life, the report pointed out.

Furthermore the results of the scientific research carried on by such institutions have been of well-nigh incalculable worth to the economic life of the nation. When viewed from these two standpoints alone the general scheme of higher education of the country must be regarded as a principal, productive asset, the conservation and further development of which are matters of permanent concern for the states and for the nation.

No reduction of the extent to which the youth of the nation is given education at public expense was recommended by this committee.

The effective, economical and non-political operation and adaptation of the plan of popular education, at all levels, from the elementary schools through the universities, are fundamental obligations of the American state.

During a period of economic stress such as that now existing, there is imposed upon all of those in positions of responsibility, whether in government, industry or cultural activity, a clear responsibility of affirming the inherent basis of our American plan and of promoting confidence among the people in their educational institutions.

With the rapid changes occurring throughout the world and especially in our own country, we face problems vastly more numerous and more difficult and more immediate than those we have faced in the past. There will consequently rest upon the publicly supported higher institutions a greatly increased responsibility for research and guidance. Adult education in particular should open opportunities for preparation for a new civic era. It is imperative that nothing should be done now to impair the service of our higher institutions in this field of all important democratic education.

THE VIENNA MEDICAL FACULTY ON YEAST TESTIMONIALS

MEMBERS of the Vienna medical faculty who have given medical testimonials in favor of yeast have been "officially sharply reproved by the dean," that official, Professor Dr. Ernst Pick, has just informed the American Medical Association. All members of the faculty were forbidden to give any testimonials intended for advertising purposes in the future.

The statement to the American Medical Association was signed by both Professor Dr. Pick, dean of the medical faculty and director of the pharmacological department, and by Professor Dr. Roland Grassberger, formerly dean of the medical faculty and director of the hygienic department.

An investigation by the faculty showed that not a single member of the Board of Professors (heads of departments) of the medical faculty is involved in the yeast testimonials, and that the only ones concerned were seven privat-docents not included on the board, not one of whom has the official position of teacher or is in charge of a department.

Privat-docents, according to the statutes of the universities of Austria, explains the American Medical Association, are not appointed by the state but merely permitted by the state to teach.

The Vienna medical faculty statement contended that the testimonials favoring yeast were "spread and misused for advertising in American illustrated and other magazines in quack-fashion."

The medical faculty is concerned lest through the impropriety of these advertisements the reputation and esteem of the Vienna Medical School be seriously affected among the medical profession and people in America, and requested the American Medical Association to spread the explanation of the situation among its members and also publicly.

DEFICIENT DIET AND MENTAL EFFICIENCY

THE fear that a diet deficient in essentials might have an immediate effect on ability to do mental work may be groundless, if results of an experiment with rats apply to human beings.

The ability of white rats, 90 to 100 days old, to do the mental task of threading a maze, when they were suffering the effects of faulty diet, was tested by Dr. Martin F. Fritz, of the Iowa State College.

The 148 animals were divided into three groups, only one of which had a normal diet of bread and milk. One group received a diet containing too much iron salt and iodine and too little chlorine. The diet of the third group was also deficient in vitamin B.

The animals having the faulty diets took somewhat longer to find their way through the maze, but there was very little difference between the groups in number of errors. Even those animals who died during the experiment showed no significant differences from others in the same group.

Dr. Fritz makes three suggestions as possible explanation of this preservation of mental ability in the face of physiological breakdown. Storage, he said, may be an important factor. Since the rats were 90 days old, they had had opportunity to store vitamin B in the liver.

There is also the possibility that in mature rats the nervous system is afforded a certain amount of protection so that a breakdown in other parts of the physiological organism resulting in death will occur before there are marked effects upon the nervous system, he said, and cited an experiment which showed that the muscles of a starved cat had lost 30 per cent. while heart, brain and cord lost only 3 per cent.

Finally, it may be that even though the nervous system is subject to degeneration, only a part of the fibers are necessary to carry on the task.

THE WORLD'S LARGEST SHIP

WHEN the *Normandie* puts to sea, the French merchant marine will more than recapture its position lost by the tragic burning of the *Atlantique*, the world's twelfth largest steamship.

The *Normandie* is the largest vessel in the world, clearly exceeding the *Leviathan* and the *Majestic* in both tonnage and length. She was launched during the past fall at St. Nazaire to be put in transatlantic service in 1934.

France now has only one vessel larger than the *Atlantique*, that is, the *Ile de France* of 43,153 registered tons, the tenth largest steamship, according to Lloyds. It is exceeded in both tonnage and length by the *Leviathan*, U. S.; *Majestic* and *Berengaria*, British; *Bremen* and *Europa*, German; *Olympia* and *Aquitania*, British, and *Rex* and *Conte di Savoia*, Italian.

The *Normandie* has an overall length of 1,027 feet, 963 feet between perpendiculars, and will be rated at approximately 75,000 gross tons. The *Leviathan's* registered tonnage is approximately 60,000, more than the *Majestic's* 56,000, but her length between perpendiculars is only 907 feet 6 inches compared with 915 feet 5 inches for the *Majestic*.

The *Normandie's* breadth of 119 feet 6 inches accounts chiefly for her greater tonnage. The vessel is a little more than 19 feet wider than either the *Leviathan* or the *Majestic*.

In addition to excessive size, the *Normandie* will contain the largest electric motors ever built. Rated at 40,000 horsepower each, the new motors will give the vessel a total horsepower of 160,000; but even then she

will not be the most powerful ship. The U. S. S. airplane carriers *Saratoga* and *Lexington* bear this title with 180,000 horsepower plants in each. Each contains eight motors rated at 22,500 horsepower, connected in pairs to four propelling shafts.

The *Normandie's* claim to fame would probably not be so clear-cut had work on the new British Cunard liner, *R–534*, continued. But, because of economic conditions, construction was suspended almost a year ago on this vessel which, it was announced, would be rated at 73,000 tons and would have a length of 1,018 feet.

The *Normandie's* hull is divided into 12 water-tight compartments. There are eleven decks, five of which are continuous from stem to stern. Accommodation will be provided for 930 first-class, 680 tourist and 560 third-class passengers, which, with 1,320 officers and men, will allow the ship to carry 3,490 persons.

The turbo-electric machinery has been designed for a service speed of 30 knots to enable the vessel to cross the Atlantic from Havre to New York by way of Plymouth, under all conditions, in less than five days.

ITEMS

COSMIC rays raining on the meeting of the American Physical Society at Atlantic City were seen as flashes of light on a novel electric sign arrangement devised by Dr. Thomas H. Johnson, of the Franklin Institute. To sensitive cells which were discharged electrically whenever they are hit by an incoming electric ray, Dr. Johnson connected neon flash lamps in such a manner that they were lighted whenever a cosmic ray hit. The "hodoscope," as he called the new detector after the Greek for "way" and "aim," had a panel of 58 lamps and the direction from which the rays came was shown by the streaks of light upon it.

FOR the first time, evidence on the possible shape of the active particles in the filtrable viruses that cause such diseases as smallpox, yellow fever, hog cholera and plant mosaics was placed before a scientific body, when Drs. William N. Takahashi and T. E. Rawlins, of the University of California, presented their report to botanists attending the meeting of the American Association for the Advancement of Science. If the invisible, filter-passing particles in these viruses have the shape of tiny rods they should present a bright appearance if light waves arranged all in one direction fall on them at the proper angle. Accordingly, a beam of polarized light, in which all wave-fronts are parallel, was directed on a solution of a virus flowing from a small tube. The solution did present a bright appearance, confirming the hypothesis.

COMPLETE success in protecting dogs and other animals against distemper is claimed in the final report of "The Field" Distemper Council, of which the Duke of Portland is president, as the result of ten years' research and subsequent enterprise of commercial laboratories. A virus, a vaccine and an anti-serum have been produced, and a healthy dog can be given lasting protection against distemper infection by the inoculation of vaccine followed a fortnight later by one of virus. If the anti-serum, used alone, is given sufficiently early in the disease, it will lessen the severity of an attack of distemper. A survey of the results with the vaccine-virus method showed that, where exposure to infection was certain, the incidence of distemper among 650 foxhounds belonging to 23 hunting packs was only 1.4 per cent., and the deathrate 0.3 per cent. Without inoculation the incidence among young foxhounds is nearly 100 per cent., and the deathrate frequently 50, and sometimes more than 75 per cent.

AN epidemic of plague may break ont in London sooner or later if present conditions continue. This suggestion was made by one of England's eminent professors of medicine, Dr. W. Langdon Brown, Regius professor of physic at Cambridge University. The plague-carrying flea lives on rats, but black or dark rats are a worse plague menace than brown ones. In Britain black rats are gradually increasing. If they are allowed to continue to multiply a plague epidemic in London is likely to follow. In big cities such epidemics tend to break out as soon as carriers of the germ become sufficiently numerous. London's freedom from plague epidemics since the "Great Plague" of 1664–5 has been due to the dominance of the brown rat, which came to England on ships, bred very rapidly and almost exterminated its natural enemy, the black rat. During recent years, however, there have been so many campaigns against rats in general that millions of the brown rats have been destroyed. The race of black rats has thus been able to make headway.

WHATEVER may be the cause of common colds, bad weather brings on epidemics of them, scientific studies have shown. "Keeping dry is an elementary precaution in avoiding colds," the Metropolitan Life Insurance Company advises. Officers of the company offer the following explanation of how chilling of the body from clothing that has become wet during stormy weather may induce a cold: "A child who goes out in a storm without proper protection collects a certain amount of water in his shoes and clothing. If he has just had a good meal and is well nourished, during the time he is physically active, he generates enough heat from his food or stored-up energy to compensate for the extra demand which the evaporation of this water makes. At the end of his journey to school, his shoes and stockings may carry a large quantity of water. From a condition of marked physical activity, he becomes relatively quiet. His heat output decreases just at the time that evaporation of the water in his shoes and stockings—the drying process—calls for extraordinary quantities of heat. This unusual demand comes at a time of decreased production and evidently places a strain on the body's heat-regulating mechanism so great, at times, as to break down the ordinary defense, and a cold frequently follows."

SCIENCE NEWS

Science Service, Washington, D. C.

THE STRUCTURE OF EARTH'S INTERIOR

How earthquakes and other natural events help geologists and geophysicists to form ideas of the inaccessible interior of the earth was related by Professor R. A. Daly, of Harvard University, in his presidential address before the meeting of the Geological Society of America in Cambridge, Massachusetts.

Ordinary rocks, like granite, sandstone and limestone, forming the forty-mile-deep crust of the earth, are aggregates of larger or smaller crystals. Below the crust and all the way to the center of the globe the temperature is too high to permit crystals to form. Down to the depth of about 1,800 miles the material is vitreous, or glass-like. On account of the dead-weight pressure, increasing from 15 tons to 7,000 tons on the square inch, this glassy "rock" is on the average more rigid than steel. Hence it can transmit earthquake waves of the "shear" or "shake" kind.

This thick shell of rigid glass overlies a core, which, in spite of a minimum pressure of 7,000 tons on the square inch and maximum pressure of 22,000 tons on the square inch, seems to a number of expert seismologists to act like a true liquid; if so, the core can not transmit the shear waves. It is generally regarded as essentially a huge ball of metallic iron, chemically like the meteoritic iron of our museums of natural history. If the core is liquid, it must be at a temperature much higher than that of the electric arc.

The thin, crystallized crust itself is layered, lighter rock resting on heavier rock. Similarly the thick, vitreous shell is layered, with a downward step-wise increase of density. At the depth of 1,800 miles the material is more than twice as dense as granite, but at that deep level the density rises abruptly so as to be nearly four times that of granite or ten times that of water.

The great heat of the interior was explained as largely primitive, inherited from the earth's beginning. A fraction of the heat is of radioactive origin and has been generated by the violent explosions of atoms in the rocks, particularly within the thin crust itself.

Because more than 97 per cent. of the earth is too hot to crystallize, its body is extremely weak. True strength is almost, if not entirely, confined to the crust, which, being so thin, must bend if over wide areas it becomes newly loaded with glacial ice, ocean water or deposits of sand and mud. It must bend in the opposite direction if widely extended loads of such material be removed.

Professor Daly's theory of the earth thus accounts for some of the major reshapings of the planet during its long history. The theory seems best to account for the continued existence of dry land; for the origin of chains of high mountains; for the rise of molten rock, or lava, into the crust or all the way to the earth's surface, as volcanoes, and for the great chemical variety of of the world's lavas.

Yet Professor Daly was careful to point out that, in spite of support from modern conclusions about the earth's origin, from earthquake studies, from the record of temperatures found in deep mines and bore-holes, from the nature of volcanic action, and from the myriad facts now known about "igneous" rocks, the general theory he described is best regarded as a working hypothesis, a useful guide to research during the decades to come.

ABBE LEMAITRE ON COSMIC RAYS

PROFESSOR ALBERT EINSTEIN has given his scientific blessing to the ingenious theory proposed by Abbé Georges Lemaitre that cosmic rays are birth cries of the universe and the radiations from the super-radioactive primeval matter that existed when the universe was young.

Abbé Lemaitre, the young Belgian priest-cosmologist, first proposed this idea of cosmic ray origin in 1931. He has now expounded it to investigators at Pasadena with Professor Einstein in his audience.

The father of relativity commented upon the Lemaitre "birth cries of the universe" theory by saying that "if matter is short-lived Lemaitre's theory is inevitable" and that besides no other theory agrees so well with all observations.

Abbé Lemaitre stated that cosmic radiation contains a thousandth of the total existing energy. He views the commonest elements as analogous to alpha rays that are emitted by radium.

The difference of interpretation of the nature of cosmic rays existing between Dr. Robert A. Millikan and Dr. A. H. Compton was touched upon by Abbé Lemaitre. He explained that beta particles or electrons must show latitude effect which moreover seems to exist. This upholds the Compton idea. But Abbé Lemaitre added that experiment shows that a preponderance of cosmic rays consists of photons or radiations like light rays. This upholds the Millikan idea.

The original energies of the "universe's birth cries" radiation have been greatly degraded by the red-shift effect, Abbé Lemaitre explained. This is the effect that when observed in the spectra of the far-distant nebulae indicates that the universe is expanding at a tremendous rate. Abbé Lemaitre was the first to enunciate the expanding universe theory later sponsored by De Sitter, Einstein and other "universe makers."

METHYLENE BLUE AS AN ANTIDOTE

SEVERAL thousand persons are killed each year by carbon monoxide gas and by cyanides. If half this number could be saved by the newly-discovered antidote, methylene blue, Dr. Matilda M. Brooks and Dr. J. C. Geiger, of San Francisco, would have made an epochal contribution to medicine and the welfare of mankind.

For Dr. Brooks, working in the department of zoology,

University of California, hit upon the idea of using the common bacteriological stain as an antidote for these two poisons, and Dr. Geiger, director of public health, promptly put the idea into use and two lives have already been saved.

Dr. Brooks was carrying on research in biology, working in pure science when she made the methylene blue discovery. She knew that earlier investigators, chief among them Professor Otto Warburg, of the Kaiser Wilhelm Institute for Biology, Berlin, found in connection with work on yeast cells and other organisms, that methylene blue counteracts the effect of cyanide and of carbon monoxide on living tissues. Dr. Brooks took the next step and tried the effect of methylene blue on animals that had been poisoned with carbon monoxide or with cyanide. She found it a successful antidote with small mammals, such as mice and guinea-pigs, and in a report of her work to the Society for Experimental Biology and Medicine in April, 1932, she suggested the use of methylene blue in human cases of cyanide or carbon monoxide poisoning.

When Dr. Geiger called on Drs. P. J. Hanzlik and C. D. Leake, professors of pharmacology at Stanford University and the University of California, respectively, for modern methods of treating poison cases, they suggested to him, among other methods, the methylene blue method for cyanide and carbon monoxide.

As a result of its successful use, methylene blue may become part of professional first aid kits, such as those carried by fire and police rescue squads. The method used at the Park Emergency Hospital at San Francisco consists of injecting into the patient's vein a one per cent. sterile aqueous solution of methylene blue, which is listed in the U. S. Pharmacopoeia as methylthionine chloride. In the first cyanide poisoning case reported, 50 cubic centimeters, or nearly two ounces, were used. The patient stated that he had taken 15 grains of potassium cyanide in about 4 ounces of water.

A NEW VARIETY OF BARLEY

A NEW type of barley that is more disease-resistant, that will yield more, and that incidentally will make a finer and more potent brew for beer, has been perfected at the University of Wisconsin by Professor Benjamin Donald Leith, and was one of the five crops that was awarded a place in the "Hall of Fame" of the International Livestock Exposition at Chicago, Illinois.

In 1918 Wisconsin annually raised 38 million bushels of barley, most of which went into the huge beer vats of the state. It was famous as a good "beer barley," but it had one serious drawback. On its stalk were hundreds of little inpointing barbs. These stalks would get into the harvesters' clothes and would creep up and up, despite frenzied efforts to get rid of them. Things got so bad that the farmers' helpers refused to harvest barley crops, and there was a general appeal to the university for help.

Professor Leith was set at work to discover a new barbless type of barley, and it was only a month or so ago that he announced the completion of his work. The new barley has been given the official name of Wisconsin Barbless Barley, Pedigree 38. It is almost entirely resistant to striped disease, the scourge of barley. An increase of from ten to twenty bushels to the acre has been made in its yield.

Gustave W. Pabst, a well-known Milwaukee brewer, has tested over 5,000 bushels of it at his own expense and has found that for brewing purposes it is a vast improvement even over the old barley.

Seed for the Pedigree 38 barley has been distributed over the entire United States by the university agricultural department and preparations are all made for a colossal comeback of the barley crop—provided Congress legalizes beer.

FACIAL EXPRESSIONS OF THE BLIND

THE pantomime of smiling for politeness' sake, and of putting on an expression of fear or concern when a friend tells of a slight mishap, is a language of which the blind know scarcely "a single word."

This is the report of M. Georges Dumas, who has studied the quiet, often apathetic faces of the blind in French institutions, to find out whether they mimic expressions at all, as seeing persons do. His studies, reported in the *Journal of the American Braille Press,* shed light on the origin of the social art of looking pleasant.

The blind laugh or look sad when genuinely stirred. But those interviewed by M. Dumas did not know how their faces changed in emotion, nor how to produce these expressions at will.

One blind man, accustomed to self-analysis, said: "I know perfectly well what you ask me, but I do not know how joy, sorrow or anger are expressed on my face."

The same man said that he did not feel that his happy, laughing face was different from his face when sad.

M. Dumas attributes the absence of mimicry in blind people to their inability to observe other people and to imitate their expressions. Before his study of the blind, he said he had thought it likely that human beings learn mimicry by a different method from imitating others. He had speculated "that we imitate voluntarily in our own spontaneous expression after becoming conscious of it through our own muscular and cutaneous sensibility."

M. Dumas concludes: "It would obviously be a great service to the blind to teach them mimicry which would make them seem more like ourselves. It would draw us nearer them and at the same time help to adapt them to community life from which their blindness isolates them."

ITEMS

REPORTS received at the U. S. Public Health Service indicate that influenza is decreasing throughout the country, both in the number of cases and in the number of deaths. For the week ending January 7, the latest for which figures are available, there were 72,241 cases reported throughout the country. This is almost twenty thousand less than the previous week's total. Deaths

for 85 cities of the country have also decreased from 14.7 per thousand to 13.6. While the epidemic is not yet over, no more great rise in the number of cases is expected. Health authorities have pointed out, however, that little waves of increased influenza prevalence always follow a large outbreak, and such small waves may continue for the rest of the winter.

BORON is the latest chemical atom to be smashed at the Cavendish Laboratory, Cambridge, by Drs. J. D. Cockcroft and E. T. S. Walton, who last year succeeded in smashing lithium in a similar manner with a release of atomic energy. Bombarding boron atoms with speedy hydrogen atomic hearts, they obtained electrically charged helium atomic hearts or alpha particles. Twenty-five times the number of helium atoms were obtained from the boron bombardment than had previously been obtained with lithium. But as yet the atom smashing is not a useful process in a practical way since roughly only one alpha particle is emitted for every two million proton hydrogen hearts flung at the boron by an electrical potential of 500,000 volts. The Cambridge physicists wrote to *Nature:* "The ionization produced by the particles suggests that they are alpha-particles and the energy of the main group would support the assumption that a proton enters the boron nucleus (of atomic mass eleven) and the resulting nucleus breaks into three alpha-particles."

THE first steps toward making a female sex hormone in the chemical laboratory seem to have been taken by two British investigators, Dr. J. W. Cook, of the Cancer Hospital, and Dr. E. C. Dodds, of the Middlesex Hospital, London. They have produced a chemical compound which, when injected into castrated rats, has an appreciable oestrogenic action similar to that of the sex hormone, oestrin. In their report to *Nature,* Drs. Cook and Dodds give the following formula for their compound: one keto, one, two, three, four tetrahydro phenanthrene. Phenanthrene is a coal-tar product used in the artificial production of dyes and drugs. The rest of the new compound's name tells the chemist the way in which additional hydrogen and oxygen are combined with the phenanthrene. At least four female sex hormones have been reported in recent years from research centers in the United States, Canada, England and Germany. They have been obtained from human placental material and from the kidney secretions of expectant mothers.

MADE visible by invisible light, dials on an aviator's instrument board will glow in darkness so that the pilot may see distant beacons without being blinded by close-up lights. This lightless, yet efficiently usable airplane "dashboard," has been described before the Illuminating Engineering Society by S. G. Hibben, of the Westinghouse Lamp Company, as a new application of ultra-violet light. The dial figures are to be covered with a special paint which fluoresces under ultra-violet light.

THE time designations of A. M. and P. M. will be obsolete and the hours run from 0 to 24 in British post offices if a proposal before the House of Lords finds approval. The movement for continuous numeration of the hours has the support of Sir F. W. Dyson, who recently retired as astronomer royal, who says that there is no valid objection against the 24-hour system which is less confusing and has been in use on the European continent for a long time. Astronomers already use the 24-hour notation, with 0 at midnight and 13 o'clock corresponding to old-fashioned 1 P. M.

THE germs that cause colds in the head are harmless at certain times even if they reach a human being in food, water or air. This is the theory advanced by Dr. E. C. Rosenow, of the Mayo Clinic, and reported to the Society of American Bacteriologists. Colds and other respiratory diseases occur when germs belonging to the ever-present streptococcus family acquire peculiar virulence and other properties. Contact with persons suffering from colds is not of prime importance in the spread of this or other respiratory ails. In these studies Dr. Rosenow used his newly-developed method of identifying peculiar properties of disease organisms by their electric charges. In this way he found streptococci of the same charges and disease-producing potency for animals in the throats of persons suffering from the usual colds and allied ailments of early autumn, from the raw milk and water supplied, and from flies.

EYES act as glands, in certain animals at least, secreting a substance that causes the contraction of color-bodies in their skins and thus controls their chameleon-like color changes. Experiments pointing to this hormone-production by eyes were reported by Professor Lloyd M. Bertholf, of the University of Western Maryland and the University of Munich, in a paper before the American Society of Zoologists. The animals furnishing the color-changing extract were crustacea. The hormone was found in the stalks on which their protruding eyes are mounted. The eye-stalk extract, when injected into the body, produced color changes not only in crustacea, but in frog tadpoles and several species of fishes—animals far removed in the zoological realm from the invertebrate crustacea.

GRASSHOPPERS will not cause major crop damage in the West during the coming summer, unless unexpected weather conditions favoring them should occur. This is predicted as a result of the annual grasshopper survey of the bureau of entomology of the U. S. Department of Agriculture, which has just been completed. The field research men of the bureau examine the soil in trouble-promising areas, counting grasshopper eggs and judging as well as they can the climatic conditions that favor or hinder their development when warm weather returns. In only one state, North Dakota, is the egg-count higher than it was in the fall of 1931, though there are local "bad spots" in a number of other states. In these places the farmers may again have to spread poison bran bait for the young 'hoppers, unless a cool, moist spring favors the development of parasites and fungus diseases and thus keeps the numbers of the insects down by natural means.

SCIENCE NEWS

Science Service, Washington, D. C.

ARTIFICIAL PRODUCTION OF NEUTRONS

ARTIFICIAL production of neutrons in larger quantities than the world has hitherto known has been achieved by Drs. Charles C. Lauritsen, Richard Crane and Andrew Soltan at the California Institute of Technology.

This is considered the greatest step in atomic physics since British experimenters, Drs. J. D. Cockcroft and E. T. S. Walton, of Cambridge, disintegrated lithium last year and released atomic energy. It shows that possibilities lying within the nucleus of the atom are practically unlimited, in the opinion of those who have analyzed the work.

In the experiments just performed the metal beryllium was disintegrated with artificial alpha rays or hearts of helium atoms. These were given a push of half million volts. Slow neutrons, which probably have under a million volts of energy but which nevertheless penetrate two inches of lead, were produced.

The neutrons were measured with a small electroscope about the size of a fountain pen which was devised by Dr. Lauritsen. Paraffin was used as a detector, the neutrons, or electrically neutral particles, plunging into this substance and giving rise to radiation that affected the roentgenometer or small electroscope.

This experiment was the first time that neutrons had been produced without use of radioactivity. This means that the quantities and intensities of neutrons to be produced in the future will undoubtedly be much greater as the bombarding radiation can be supplied by extremely high voltage apparatus that is now being built in not one, but several, laboratories. The alpha particles used were accelerated by one of the institute's giant high voltage tubes.

The ranges of neutrons and protons so produced will soon be measured accurately and this will mark the beginning of the spectroscopy of the nucleus of the atom. Far-reaching developments are expected from this new field comparable with the advances brought about by the exploration of the outside portion of the atom in the past decade.

PROFESSOR EINSTEIN AND ABBE LEMAITRE

"CAN you explain, Professor Lemaitre, in simple terms without too many mathematical symbols, the important features of your theory?" That is exactly the question asked by Professor Einstein at a symposium on relativity at the California Institute of Technology. It was a gathering of scientific men interested in relativity, and a small crowded room contained an imposing set of personalities: Professor Einstein, Abbé Georges Lemaitre, Professor P. S. Epstein, Dr. H. Bateman, Dr. E. T. Bell, Dr. R. C. Tolman and Dr. T. von Kárman.

First Professor Epstein presented an interpretation of the so-called cosmical constant. This was promptly attacked by the others but successfully defended by Professor Epstein. Finally he himself dealt a death blow to his suggestion.

Then the Abbé Lemaitre took the floor, and Professor Einstein asked his question. It was not entirely facetious, for Professor Einstein thinks about the fundamental ideas before he worries about questions of technique which he can later develop with ease.

The essence of the discussion was the use of the cosmical constant. Professor Einstein had introduced it into relativity, but when Dr. Edwin Hubble, of Mount Wilson Observatory, found that light coming from distant nebulae was considerably reddened, he no longer found it necessary. His present position is that if one can get along without this constant it might be better to do so. However, Abbé Lemaitre contended that while he could not prove the constant was an absolute necessity for a consistent theory, it was certainly legitimate and would moreover lead to useful results. Thus with its help he could explain the formation of the nebulae. This was exactly what Professor Epstein had just concluded was impossible on any classical non-relativistic basis. He had tried to do this twenty years before, but the present discussion brought out the deficiencies of the method.

Professor Einstein pointed out that it might nevertheless be possible to explain the formation of nebulae with a relativity theory, but without a cosmical constant. He also mentioned that this constant played a part like matter of negative density. It moreover expressed the instability of a uniform or even distribution, so that if a hole was formed it would push matter away from itself and thus enlarge; it is like a negative gravitational force or a repulsion.

Abbé Lemaitre countered that he felt it would be impossible to construct such a theory, but he said he could not rigorously substantiate his feeling. However, he added a very important argument in his own favor. He showed that without the cosmical constant, designated by the small Greek letter lambda, it would be extremely difficult to explain the rapid development of the universe. This on classical grounds would require a thousand million million years (10^{18}) while only about ten billion (10^{10}) are available. On the other hand, it might be mentioned that lambda is responsible for the recent short estimates of the age of the universe.

Next Professor Tolman warned against possible neglect of complications which occurred in nature. It is very hard to tell which are unimportant and which are significant.

The discussion took place in three languages. Professor Einstein usually began to speak in adequate English. He would generally feel hampered and soon go on in German. Abbé Lemaitre showed slight difficulty with that and then Professor Einstein burst out in French, which came much more easily than his English.—R. M. LANGER.

CLOUDS IN THE STRATOSPHERE

THE existence of clouds at heights from 15 to 19 miles above the earth, a region of the atmosphere where clouds have never before been believed to exist, has been established recently by observations made in Norway by Professor C. Störmer with the photographic equipment he has successfully used in measuring the height of aurora.

These high clouds have been called "Mother of Pearl Clouds" on account of the pureness of the spectral colors with which they glow and the concentric arrangement of their coloration in band after band similar to the color scheme inside a clam shell. Shades of pink, lilac, purple and blue occur, but generally reddish hues predominate. These colors shine about as bright as in an average rainbow and may be seen only near sunset, increasing rapidly in brightness immediately after the sun sets.

Mother of Pearl clouds have been reported most frequently after the passage of a center of low pressure, but have not been observed generally, on account of the thick low cloud obscuring their view. On the lee-side of mountains, however, the föhn winds dissolve these rain and storm clouds, permitting a view of the extremely high cloud. Mother of Pearl clouds have been found to remain stationary for hours and on other occasions to move with velocities up to 100 miles per hour. On January 13, 1929, they were observed to fall steadily a distance of one mile in an hour and a quarter.

The origin and constitution of these clouds has not so far been explained. The highest cirrus clouds formed from floating ice crystals are only eight miles high in these latitudes and until these Mother of Pearl clouds were discovered, the stratosphere was considered cloud-free except for the noctilucent clouds about fifty miles high and supposed to be associated with volcanic ejecta.

Observers in states and provinces just east of the Rockies would appear to be favorably situated to observe these extraordinary brilliant clouds especially during chinooks. The observer should note the time, arrangement and brilliance of colors as well as the direction and velocity of the cloud.—ANDREW THOMSON.

FOUCAULT EXPERIMENT

DELEGATES to the annual meeting of the Royal Astronomical Society of Canada, held in Toronto, saw a new version of a celebrated experiment which demonstrates the rotation of the earth, using only an iron ball and a long wire as the apparatus. It was shown by the President, Dr. R. K. Young, who is associate professor of astrophysics in the University of Toronto.

Known as Foucault's pendulum, from the name of the French physicist who devised it, the experiment created a sensation when it was first shown in the Pantheon in Paris in 1851. Foucault suspended a heavy cannon ball at the end of a 200-foot wire, fastened in the ceiling. Attached below the bob was a pointer, sweeping out a track in a layer of sand. The scientist gave the ball a push, starting it swinging. It drew a line in the sand each time the motion reversed. As the hours passed, the line slowly rotated, an effect attributed to the earth's rotation. The pendulum continues tc swing in the same plane in space in which it is started, while the earth turns beneath it.

The demonstration here removed anomalies from the original experiment. It has been found that the pointer on the iron ball usually traces a narrow ellipse in the sand, instead of reversing in a straight track, a behavior not previously explained. Dr. Young suggested a reason for the looping. He hung the suspension wire through a small, rigid ring, which took out the side-play through friction. He said: "The tendency for the ball to travel in an ellipse may be due to the flattening of the earth at the poles.

"When the pendulum is not moving, it hangs perpendicular to the earth's surface. If the earth were a perfect sphere, the pendulum line would pass through its center. But the world is not exactly round. A perpendicular to its surface at intermediate latitudes does not go through the middle.

"This fact introduces an additional small force, which encourages the Foucault pendulum to move in an ellipse."

At Toronto the pendulum path turns through a complete circle in about 35 hours. A pendulum hung over the equator does not deviate from its original path. At the North or South Pole the track would turn once every 24 hours. The rotation of the tracks of other pendulums, many of which are in constant operation in the museums of the world, can be calculated from the latitude in which the ball is swinging.

AN EXPLANATION OF STUFFY ROOMS

SIR LEONARD HILL, the well-known English physiologist and writer on public health subjects, finds that certain heat rays (infra-red rays) given off by dark or dull-red sources of heat cause the nostrils to contract and thus interfere with breathing. He believes that this is the chief reason for the stuffiness that we experience in an overheated room.

In a lecture given in London at the recent Public Health Congress he showed that this effect is not due to a direct action of the heat upon the nostrils, but that it is a reflex effect from the sensory nerves of the skin. He described the particular heat rays that give this effect as "nose-shutters."

Their action is especially marked in persons whose breathing is already partially obstructed, those with a deflected septum of the nose, for example, or a person suffering from catarrh, asthma or hay fever.

The effect can be neutralized by fanning the skin of the face with an electric fan, or by the action of certain other rays, which he speaks of as nose-openers, that are given off especially by luminous sources of heat. They may also be absorbed by water vapor and he suggests that this is the explanation of the efficacy of a bowl of water placed in front of a heater in relieving the stuffiness of a room.

He finds also that these nose-shutting rays cause a diminution in the secretion of the mucous membrane of

the nose, and since these secretions may be supposed to protect us from infecting organisms in the air, it is possible that the nose-shutters increase the risks of respiratory infections.

From experiments made at Bedford College, London, he found that 60 per cent. of the persons examined experience difficulty in breathing when exposed to heaters that give off these nose-shutting rays and that in over 25 per cent. of the cases the obstruction to breathing was so marked that it could be demonstrated in records of the respiration made upon a suitable apparatus.

CHOLESTEROL AS SOIL FOR THE GROWTH OF CANCER

CHOLESTEROL, an important chemical compound found in animal tissue, "prepares the soil" for the growth of cancer. This new theory of a cause of cancer is suggested in a report by Dr. A. H. Roffo, of Buenos Aires, in the current issue of the *American Journal of Cancer.*

Cholesterol is found in all animal fats and oils and in many organs of the body. It is related chemically to ergosterol, from which vitamin D is formed by the action of sunlight.

In the case of skin cancers, Dr. Roffo believes that cholesterol is accumulated in the skin by the effects of exposure to light and in turn acts as a condition for the production of cancer. It prepares the soil, as he expresses it, probably because under the influence of light it itself becomes photoactive, emitting emanations which affect the surrounding tissue.

As evidence for these views he presents such facts as these: Cancerous tissues show an increased cholesterol content compared with normal tissues, especially as regards the skin; tumor cells show a tendency to absorb and fixate cholesterol from the blood, or, in the case of cell cultures, from the surrounding medium.

In the skin a fixation of cholesterol in the tissues is favored by exposure to light. His analyses show that in the face and other parts of the skin exposed to light more cholesterol is present than in those parts protected from the light by clothing. He finds in this relationship an explanation of the fact that skin cancers are frequent on the face and rare where the skin is covered by clothing.

So far as skin cancers are concerned he sums up his views in the statement that "cholesterol prepares the soil for subsequent malignant growth by acting as an accumulator of light."

ITEMS

THE anti-neuritic vitamin B has been produced by the action of ultra-violet rays on adenine sulphate, B. C. Guha and P. N. Chakravorty, of the Bengal Chemical and Pharmaceutical Works, Calcutta, have reported by cable to *Nature.* Thus it appears that two vitamins are produced by activation of a chemical with ultra-violet light. Scientists found several years ago that rickets-preventing vitamin D is formed by the action of ultra-violet light on ergosterol. Vitamin B is found naturally in the bran layers of cereals, in vegetables, milk, eggs, liver and pancreas. Professor Adolf Windaus, of the University of Göttingen, isolated the vitamin in pure form a year ago and gave it the chemical formula, $C_{12}H_{17}N_3OS$. The Indian report indicates that the vitamin is the type of compound known as a purin.

FURTHER exploration of the cave at Choukoutien, China, where the Peking skull was found, has disclosed a small wrist bone not appreciably different from that of modern man and also a piece of collar-bone about the average of the length of the collar-bone of an adult male in North China to-day. Describing these discoveries, Professor Elliot Smith said that the feet of Peking Man showed that he must have walked like an ape, with in-turned toes, but there is no evidence that he shared the apes' ability to grip with his feet. The shape of his hands leaves no room for doubt that this member of the human family had already gained the skill and intelligence which stamp him as genuinely human.

THE mystery that for forty years has surrounded the highly fatal Peruvian disease known as Oroya fever is finally being penetrated, it appears from a report in the current issue of the *Journal* of the American Medical Association. Dr. Ramón E. Ribeyro, professor at the National University of San Marcos of Lima, Peru, has finally shown that the outlook in this disease is good unless it is complicated by infection with an organism known as paratyphoid B bacillus. It is this complication which is responsible for the deaths that occur in cases of Oroya fever.

THE positions of all the large thunderstorms which occur over Europe and the North Atlantic can now be determined by radio apparatus in the British Isles, independently of weather reports. This is announced by R. A. Watson Watt, superintendent of the Radio Research Station of the British Department of Scientific and Industrial Research. Atmospherics produced by the thunderstorms are so exactly analyzed by cathode ray oscillographs that with two radio stations working in cooperation it is possible to calculate trigonometrically the positions of the storms to within about a hundred miles. The two stations used are the Radio Research Station, near London, and the Leuchars Aerodrome Station, in Fifeshire, Scotland. These stations are about four hundred miles apart, and they enable thunderstorms to be located within a radius of 3,000 miles.

EFFORTS to raise antelope in captivity have at last succeeded in Alberta, with the growth of a herd of 42 to nearly 500 animals. The raising of this most timid of wild animals without its being conscious of captivity was accomplished by Canadian Government big game specialists, when they decided to save the antelope from the extinction which threatened it not long ago with the advance of settlements. A small herd of 42 animals was found grazing near Medicine Hat. The area on which it was living was fenced in, unknown to the antelopes, and now the shy animals will come to be fed. The preserve is one of two established in southern Alberta to save this once numerous animal.

SCIENCE NEWS

Science Service, Washington, D. C.

SOME PAPERS PRESENTED AT THE ATLANTIC CITY MEETING

THE distance between the United States and England appears to vary each day as the moon moves across the sky. If the hypothesis advanced to the American Astronomical Society by Dr. Harlan T. Stetson, director of the Perkins Observatory at Delaware, Ohio, and Alfred L. Loomis, of the Loomis Laboratory, Tuxedo, New York, is correct, the change in distance is about 63 feet. They make this suggestion to account for surprising variations in British and American time which have been uncovered by Mr. Loomis' researches. With what is probably the most complete installation of the latest type of precision clocks in the world, and automatic radio sets, to record time signals from a number of national observatories, he has found that the times do not agree. The time is determined at both places by observing the instant that a star crosses the meridian. Therefore, if the two observatories are shifting slightly in longitude, the star will cross slightly early when it is west of the average, and late when it is to the east. In the absence of any other satisfactory explanation, Dr. Stetson and Mr. Loomis have adopted the idea that such a shift does take place. The Loomis-Stetson hypothesis to explain this variation in step with the moon's position is that there is a natural stretching or shifting in the earth's crust, within its elastic limits, which would yield and recover periodically under the stress of the moon's gravitational pull. Another result of the studies is the indication that the radio wave takes twice as long to cross the Atlantic as would a beam of light traveling the same distance.

A NEW theory of the origin of cosmic rays was suggested to the American Physical Society by Dr. Ross Gunn, of the U. S. Naval Research Laboratory. Out in the stars that are still young there are born in great "star-spots," like sun-spots on our sun, negatively charged ions or electrons which are given great energies. These pass through the outer layers of the star and each picks up a positive ion, and the two together form an energetic neutral pair of some 10 to 100 thousand million electron volts. When such particles hit the earth they become separated in the upper atmosphere by electromagnetic forces or collisions and become the cosmic rays. Such neutral pair particles which are fathers to cosmic rays are uniformly distributed in space, Dr. Gunn believes, thus accounting for the cosmic radiation coming from all directions. The sun-spots give rise to weaker neutral radiation which gives rise to the aurora and magnetic storms but are not powerful enough to generate cosmic rays.

A NEW process of x-ray generation, caused by the passage of a swiftly moving electrified particle through gas, was reported to the American Physical Society by Dr. Gordon L. Locher, National Research Fellow at the Bartol Research Foundation of the Franklin Institute. Dr. Locher discovered the new process of ionization while investigating the nature of the cosmic rays. Part of the charge in an ionization chamber such as used for measuring the cosmic radiation is caused by characteristic x-radiation generated by the passage of the cosmic radiation particle through it.

THE new type electrostatic high-voltage generator, invented by Dr. R. J. Van de Graaff, and constructed by the Massachusetts Institute of Technology at Round Hill, Massachusetts, with a Research Corporation grant, will develop a steady direct current potential of 10,000,000 volts with a continuous power output of about 20,000 watts. One of the first tasks of the generator will be atom-smashing. To provide a portable high-voltage machine, Dr. Van de Graaff and E. H. Bramhall have designed a rugged machine mounted on rubber-tired casters that will develop 1,500,000 volts. Both generators work on the principle of the old-fashioned static electricity generator and belts carry the electric charges to large discharging spheres.

DISCOVERY of 236 stars in the northern Milky Way with layers of glowing hydrogen surrounding them was announced to the American Astronomical Society by Dr. Paul W. Merrill and Cora G. Burwell, of the Mount Wilson Observatory. These are known as type Be stars, and are of interest to astronomers because of some of their peculiar properties. Astronomers at Mount Wilson have been making a search for them, using the spectroscope to study the lines in the stars' spectra. As a result, the total of known Be stars has been raised to 408.

ULTRA-VIOLET radiation is much more damaging to bacteria than it is to the filtrable virus class of disease causes. This is indicated by researches reported to the Botanical Society of America by Professor B. M. Duggar and Alexander Hollaender, of the University of Wisconsin. Cultures were exposed of the virus of tobacco mosaic and of three kinds of bacteria to the action of ultra-violet rays of a certain narrow range of wavelengths. It was found that the virus resisted radiation up to 150 times the amount that sufficed to kill one of the bacterial species. The spores or resting-stages of the bacteria were more resistant to ultra-violet than were their vegetative cells.

FOR the first time, evidence was brought forward on the possible shape of the active particles in the filtrable viruses that cause such diseases as smallpox, yellow fever, hog cholera and plant mosaics by Drs. William N. Takahashi and T. E. Rawlins, of the University of California. If the invisible, filter-passing particles in these viruses have the shape of tiny rods they should present a bright appearance if light waves arranged all in one direction fall on them at the proper angle. Accordingly, they directed a beam of polarized light, in which all wavefronts are parallel, upon a solution of a virus flowing from a small tube. The solution did present a bright appearance, confirming the hypothesis.

A CHANCE mosquito bite of a chicken or a monkey may be an unsuspected source of malarial infection. Studies showing that chickens may be infected by certain strains of malaria were reported by Professor Reginald D. Manwell, of Syracuse University. It has not been known generally that such large birds as chickens could get malaria. This is because the disease runs a short, mild course in the barnyard bird and so is not recognized. Professor Manwell's discovery that chickens could be infected resulted from efforts to find a more suitable bird than the canary for his studies of the disease. Since chickens can be infected artificially, Professor Manwell questioned whether they and other animals hitherto supposed to be not susceptible to malaria may not also be infected in nature. It that case they would serve as unrecognized reservoir hosts, their blood containing enough malarial parasites to infect other mosquitoes but not enough for detection by ordinary microscopical methods. It is quite conceivable that monkeys or other mammals might in this way contribute to the perpetuation and spread of human malaria.

DR. MICHAEL LEVINE, of Montefiore Hospital, New York City, reported to the American Phytopathological Society that, after many vain attempts, he had finally succeeded in inducing a cactus to develop crown gall, a form of plant tumor caused by a microorganism. His efforts to produce the disease in smaller cacti, like the familiar prickly-pear, were not successful, but when he inoculated young specimens of the Sahuaro, or giant tree cactus of the Southwest, he obtained the characteristic abnormal growths. However, the resistance apparently natural to cacti appeared partially even here, for the internal structure of the plant tumors on the Sahuaro was not that of fully developed crown galls, but remained in a more or less juvenile or embryonic condition.

MOTION PICTURES demonstrating how nerve fibers grow through living tissue, and how they repair themselves when injured, were shown by Professor Carl C. Speidel, of the University of Virginia. Professor Speidel, who was the winner of the $1,000 prize of the association at the midwinter meeting at New Orleans last year, gave a summary of his work up to that time and of advances made since then. As explained by Professor Speidel, nerve growth is pioneered by what are known as "growth cones" on the ends of the nerve fibers. These are thickenings of the tips, which probe their way through the tissues, constantly sending out and retracting tiny processes from their surfaces. As the nerve progresses, special cells develop along its course. They hug its sides closely, though they take no part in its actual growth process, nor in its function as a nerve. These are known as the "sheath cells." Finally, as the nerve becomes more mature, it develops around itself a layer of fatty material called the "myelin sheath."

THE exact way in which a single tuberculosis germ multiplies into three or more new germs has been observed by Professor Morton C. Kahn, of Cornell Medical College, New York. Bacteria or germs have a life cycle something like the egg, the pupa and the butterfly. Professor Kahn was the first to work out that cycle for the tubercle bacillus. He considers that the question of how disease-producing bacteria reproduce, or multiply into more bacteria, is one of the most important problems confronting present-day bacteriologists. The rod-shaped tuberculosis germ cleaved into three or more oval bodies which became further reduced in size to extremely fine granules. From these tiny granules very small and delicate rod-shaped types developed. These rods finally elongated and thickened until they became the same size and shape as the tubercle bacillus from which they started. These new, rod-shaped tuberculosis germs were able to produce typical tuberculosis in guinea-pigs. Contrary to the claims of some investigators, Professor Kahn did not find that the tubercle bacillus, even in the form of the almost sub-visible granules, could pass through fine-pored filters. He did find that some of the fine young granules and rods formed from the original tubercle bacillus lost the family characteristic of retaining certain aniline stains even after exposure to acid.

DR. ROSEBURY and his associates at the College of Physicians and Surgeons, Columbia University, have found that they could produce or prevent dental fissure caries in rats at will by changing the size of the particles of uncooked rice in the rat diet. No tooth decay occurred when cooked rice replaced uncooked rice in the diet. The type of tooth decay thus produced is so much like the dental caries of the fissures or crevices of human teeth that it is assumed that the same causes produce the condition in man and in rats. The tooth decay may be produced in healthy, well-grown rats that are on an adequate diet with plenty of vitamins, minerals and other food essentials, and that have teeth free from structural defects. Rats on adequate diets, however, have less tooth decay than rats on deficient diets. Dr. Rosebury pointed out that there are several kinds of tooth decay to be found in rats. Not all of them are comparable to human caries. Failure to distinguish between the different types of rat caries has caused much confusion in experimental studies of tooth decay in the rat.

A CHANCE that diabetics may be freed from the hypodermic injection method of taking insulin and may be able to take it by mouth instead is indicated by the chemical study of the hormone reported by Dr. Hans Jenson, of the Johns Hopkins Medical School. The activity of insulin may be due to a peptide composed of cystine and glutamic acid. It that case it might be possible to give it by mouth. Insulin itself, whether extracted from the pancreas or whether prepared in chemically pure form, is destroyed by the enzymes of the stomach and intestines. That is why it must be given by injection under the skin to be effective. If a peptide or similar protein compound of low molecular weight could be found having the insulin effect, probably enough of it could be absorbed from the stomach to make it possible to give it by mouth.

DR. W. R. COE, of Yale University, outlined the sex life of the oyster. He said in part: "It was formerly believed that the commercial oyster of our Atlantic coast

was of separate sexes and that the sexuality of any individual remained unchanged during its entire lifetime. Recent studies, however, have shown that this is not entirely correct, for it has been proved that an individual that has functioned as one sex during one spawning season may assume the opposite sex the next year. But only a small proportion of the adult oyster population shows this change in any one year, the majority of individuals retaining the same type of sexuality for two years or more. And it is not improbable that some—perhaps many—individuals retain the same sex throughout life or, at least, after passing through an initial male phase during their first or second year.''

MANY seeds of trees, shrubs and other plants of commercial or ornamental value are wrapped up in coats so highly resistant that it takes months or years for them to germinate. Professor J. Nelson Spaeth, of Cornell University, reported to the Botanical Society that seeds of linden or bass wood did not germinate in two years if left untreated. Chilling them at various temperatures, even as low as that of liquid air, failed to have much effect on their torpidity. But when seeds were treated with concentrated sulfuric acid for from twelve to twenty minutes, they showed 49 to 63 per cent. germination in four months. Florence Flemion, of the Boyce Thompson Institute for Plant Research, experimented with the stubborn seeds of Rhodotypos, an ornamental shrub of the rose family. These appear to need a period of ''after-ripening'' in order to germinate and grow properly. By peeling off the seed coats, she induced a few of them to grow without this after-ripening period, but they developed very slowly, and the young plants have the appearance of being dwarfs.

THE forest of Alaska is marching northward. Its front is made of young trees, none of them over a hundred years old, though a few miles to the rear there are plenty of specimens that can boast three centuries. This and other evidence of advancing tree line in the North was presented before the Ecological Society of America by Professor Robert F. Griggs, of the George Washington University. His observations in Alaska are supported by similar studies made by other botanists in the Scandinavian countries. Professor Griggs's most striking observations were made at Kodiak, which is now just beyond the timbered area, though old records indicate that areas now heavily forested were treeless a few generations ago. ''The trees at the edge of the forest are small and squat, suggesting an adverse climate,'' he said, ''but when examined they were found to be growing as rapidly as the same species a thousand miles within its borders to the southeastward. They are likewise reproducing freely.''

THE machine age may starve to death in the near future, victim of to-day's profligate use of metals, coal and oil. In his presidential address before the American Society of Naturalists, Professor Ross Aiken Gortner, of the University of Minnesota, observed that precious, irreplaceable stores of natural resources absolutely essential to modern industrial civilization are disappearing into the maws of industry and dissipated wastefully over the earth. ''In the last hundred years this lusty infant, applied science, has increased its food consumption perhaps a thousand fold,'' he said, ''and unfortunately for mankind already the shelves in some of nature's cupboard show signs of exhaustion of specific food supplies.'' Professor Gortner warns that the coal and oil supplying this energy will be exhausted within the next thousand years. More menacing is the approaching exhaustion of copper, antimony, tin, lead, zinc, chromium, manganese, nickel and iron stored in parts of the earth accessible to man. In the past hundred years the tools of science have wrested from the earth from a tenth to half of the available natural resources. Man has enjoyed them for a moment, then destroyed them or cast them aside in a form useless to coming generations. Water power, alcohol from vegetation and solar energy are totally inadequate to replace oil and coal.

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SCIENCE NEWS

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THE NEW QUANTUM MECHANICS

By Dr. R. M. Langer
California Institute of Technology, Science Service Correspondent

Professor Albert Einstein's first paper on the new quantum mechanics is soon to appear under the title: "Semivectors and Spinors." He has allowed his colleagues in theoretical physics at the California Institute of Technology to have an advance view of some of the ideas contained in this forthcoming paper which will be published in the *Proceedings* of the Prussian Academy at Berlin with Dr. Walter Mayer as the collaborating author.

Professor Einstein is careful to explain that most of the results had already been discovered by other workers. But he wrote the forthcoming paper at the request of his friend, Professor Paul Ehrenfest, of Leiden, to clarify this little known subject.

His discussion with the theoretical physicists was, of course, technical. To make it easier for his American listeners Einstein spoke in English. This is the first extended discussion that he has delivered in English. Usually he speaks in German in order to express himself more precisely and clearly. His English is, however, quite good.

Semivectors are related to vectors in somewhat the way that imaginary numbers are related to real numbers. The spinors are restricted semivectors. The vector concept is fundamental in relativity because it enables one to avoid irrelevancies. Thus it helps to discover new laws.

The semivector may suggest new physical laws also, for it has the same simplifying properties as the vector. As in the case of the vector, the semivector can furnish tensors. The famous equations of Lorentz can be written for semivectors, but no important change is involved. The Dirac equation for an electron can be derived in an elegant manner, but Professor Einstein pointed out that it was not the simplest case of its type.

He said that it would be interesting to study the simplest case. Then he went on to say that semivectors could be used to advantage in generalized relativity, but that unlike vectors they led to complicated equations.

When Professor Richard C. Tolman, of the California Institute of Technology, asked for a physical description of a semivector, Professor Einstein confessed that he had been unable to think of any geometrical or physical picture, but added that with mathematical analysis the subject could be handled with great ease.

THE UNCERTAINTY THEORY AND THE ELECTRIC FIELD OF A PARTICLE

Abbé Georges Lemaitre, the Belgian priest-professor of the University of Louvain, who has been visiting here, has extended the uncertainty theory of physics to the electrical field of a particle.

Professor W. Heisenberg, the German physicist, by developing his uncertainty principle, which held that it was impossible to know accurately the place and speed of an object at the same instant, introduced a concept of wide philosophical consequences.

Now in a letter to the *Physical Review*, Abbé Lemaitre develops formulae which allow him to conclude that for instantaneous determinations the electromagnetic field of an electron, proton or atomic nucleus is practically undetermined. To know the instantaneous field of such a fundamental particle of matter to within one part in a hundred, Professor Lemaitre computes that its charge must be at least 60,000,000 (sixty million or 6 times 10^7) times the fundamental charge on the electron which physicists designate as small letter e. This is a relatively large quantity although it is small when translated into volts.

The atom as originally visualized by Professor Neils Bohr, the Danish physicist, was considered by Professor Lemaitre in the light of these new computations of the uncertainty principle.

"Bohr was right," Professor Lemaitre said, "when he considered the field of the atomic nucleus as determining the orbit of the electron, since this field is static and remains significant when averages are taken over long periods of time. He was also right in neglecting the radiation of the moving electron, because we see now from the uncertainty principle that the only determined field is the average field during a time in which the electron has made more than 10,000,000,000 (ten billion or 10^{10}) revolutions."

FEDERAL "ECONOMY" AND MINE RESCUE WORK

The nation's "mine rescue squads" and the preventive and research work that protects 1,700,000 men and $14,000,000,000 of capital in the country's mining industry are threatened with the Congressional economy ax.

If recommended federal appropriation cuts urged by the House Committee are made, the U. S. Bureau of Mines of the Department of Commerce will have $127,000 less in funds to support the mine rescue cars, train miners in rescue and safety, operate an experimental mine and perform research on equipment and method to aid the states in preventing mine disasters.

At the present time $741,000 is provided for this work. This is only one two-hundredth of one per cent. of the nation's investment in the mining industry—an infinitesimal price to pay for protection. The budget pared the recommended funds for 1933–34 to $664,000 and now the House bill proposes only $614,000.

The eventual abolition of this fundamental research and service to the mining industry is threatened by the House Committee report just made. The committee reported its opinion that the investigations had been unavailing in many instances because the states have not made public nor acted upon the findings of the bureau. Unless the states secure improved conditions in the

mines, the committee does not favor continuance of the federal work. Evidently viewing the task of making mines safe as a static one, the committee then said, in effect, that if the mines are made safer, the rescue and safety work can be abolished.

During the past fiscal year, the Bureau of Mines aided mines and states in connection with 33 explosions in which 87 persons were killed and 59 injured; with 21 fires which took one human life, and with 40 miscellaneous accidents which claimed a toll of 58 persons killed and 156 injured.

The mine rescue cars of the Bureau of Mines have acted as the "Rescue Squads" of the mining industry. Ten such cars have been maintained, equipped and ready to speed at an instant's notice to the rescue of trapped victims of a mine disaster. They have been kept at strategic points throughout the mining territory of the country. When not needed for emergency work they were kept in constant use, traveling continuously from mine to mine giving instruction and exhibitions of first-aid and mine rescue methods. In the event of a mine disaster, the nearest car drops its training at once and proceeds to the scene of the accident, where the crew gives its valuable trained assistance in rescue and recovery operations.

Reduction of funds last year made necessary the withdrawal from service of four of these ten rescue cars. This year's slash in funds will require the withdrawal of more cars and, what is more vital in the long run, about half the curtailment will be from research.

RECLAIMING RIVER-BOTTOM LANDS

PRESIDENT-ELECT ROOSEVELT'S project for reclaiming river-bottom lands for agriculture, while marginal upland farms are returned to forest, is in a sense a return to the world's earliest recorded planned farming systems, those of Egypt and Babylonia. For in both these ancient lands the river bottoms were farmed and the uplands let alone.

In Egypt this was necessarily the case, for the uplands were deserts. But even if there had been hill lands available, they probably would have been neglected in favor of the richer lands nearer the river.

River bottom lands the world over are usually more fertile than the adjacent uplands. This is as true in the Tennessee Valley as it is in the lands of the Nile and the Euphrates and Tigris, and for the same reasons. The recurrent floods of rivers carry down the best surface soil from the uplands nearer the head of the river, as well as decayed plant and animal remains from the forests, and spread it over the inundated lowlands. In time, thick deposits of easily worked, exceedingly rich alluvial soil are formed.

It was on this alluvial land, collected as a geological tribute from vast uninhabited territories in Africa and Asian highlands, that the world's first farming civilizations rose. And it is to such a neglected wealth of river-bottom land, which now contains much of the fertility that a century of rains have washed down from the hillside farms and denuded forest areas, that President-elect Roosevelt hopes to see poor hill farmers and possibly landless men from cities transplanted.

In Egypt the annual inundations of the Nile were an almost unmixed blessing; the only great misfortune that could visit the land was that the flood might not rise high enough. In Babylonia floods were sometimes disastrous, but the twin rivers of that land were usually controlled by mighty engineering works and a network of distributing canals for irrigation. In the Tennessee Valley, and in the other lowlands to which Roosevelt's ultimate vision extends, floods will be no blessing and must be kept under control by diking, by impounding flood waters in power reservoirs, and by holding headwater streams to a more even flow by means of new forests on the hills.

THE ALUMINUM AGE

THE exhaustion of iron and steel of the present age of metals forebodes no evil for civilizations-to-come, in the picture of the future given the American Institute of Electrical Engineers at a recent meeting by Professor Colin G. Fink, of Columbia University, inventor and authority on electrochemistry.

For the next age will be that of aluminum, Professor Fink predicted. And aluminum is the most abundant common metal in the earth's crust, being even more common than much-used iron, which it is expected to supplant for many purposes.

"The keynote of the coming new era will be the large number of new products and devices," according to Professor Fink. "Among the metals the one metal to enter the widest variety of new fields will be aluminum —aluminum for railway equipment, aluminum for roofs and buildings, for food containers, for transmission, for airplanes, for tank cars, pipe lines, fencing, etc. Finally we should mention the new aluminum plate, superior to tin plate in many respects, developed at the electrochemical laboratories at Columbia.

"Whereas the supply of raw material for many of our metals is comparatively limited in years, the supply of bauxite or aluminum ore is almost limitless. Thus, for example, whereas copper at the 1929 rate of consumption will last but forty or fifty years, the aluminum ore reserves will satisfy our demands for many hundred years."

In the relative abundance of the common metals in the earth's crust, taking the parts by weight, aluminum leads with 80,000, iron is second with 50,000, while copper is seventh with only twenty. For every pound of copper in the earth's crust there are 4,000 pounds of aluminum.

VITAMIN B_2 AND PERNICIOUS ANEMIA

ONE cause of pernicious anemia may be lack of vitamin B_2 in the diet, Dr. William B. Castle, of the Thorndike Memorial Laboratory, Boston City Hospital, and the Harvard Medical School, reported to the American College of Physicians meeting in Montreal. His studies also suggest a new idea of the relation between certain vitamins and the conditions caused by their lack.

Dr. Castle received the John Phillips Memorial Prize of the college. Associated with him in the anemia research were Drs. Wilmot C. Townsend, Clark W. Heath and Maurice B. Strauss, of the Thorndike Memorial Laboratory, and Dr. C. P. Rhoads, of the Rockefeller Hospital.

Liver may be a means of curing pernicious anemia, but lack of liver in the diet is not the cause of the disease. Pernicious anemia develops in those people whose stomachs can not make their own supply of liver extract from a normal diet. When vitamin B_2 is fed to a normal human being, his stomach makes it into something that acts like liver extract because of a reaction with what Dr. Castle calls the intrinsic factor in the stomach juice. It is chiefly lack of this intrinsic factor which causes the usual cases of pernicious anemia and also some of those occurring in mothers before the birth of a child. After the child is born, however, the intrinsic factor reappears to a certain extent, as it did in one exceptional case of pernicious anemia following liver treatment.

Vitamin B_2 is found in meat, milk, eggs, the outer layer of rice, and yeast. It is lack of this factor in the diet which produces the type of pernicious anemia found in the tropical disease, sprue, and in celiac disease, an intestinal ailment of children. The vitamin factor in the cause of pernicious anemia Dr. Castle calls the extrinsic factor.

A third important factor in the development of this disease is what Dr. Castle calls "defects of absorption." Even if the vitamin is eaten in abundance and the intrinsic factor is present in the stomach juices, the body may fail to absorb the product formed by the interaction of these two factors. This is seen in certain cases of pernicious anemia or sprue in which enormous doses of liver extract have little effect when given by mouth, whereas the usual dose given by hypodermic produces a typical response.

Dr. Castle's researches have thus shown that there are three ways in which the formerly fatal disease, pernicious anemia, may be caused. It is a deficiency disease in a novel sense, since the deficiency is not so much a lack of vitamins in the diet as the failure of a reaction with a vitamin in the digestive tract or elsewhere in the body.

ITEMS

A NEW compact electrical impulse generator hurling 3,000,000 volts is reported to *Nature*, from the Metropolitan Vickers Laboratory, Manchester. The new high voltage machine is only five feet in diameter and ten feet high. It contains parallel charged, oil impregnated condensers with all spark gaps segregated in an air column with the air under high pressure. It thus combines the advantages of both air and oil gaps. The engineers who constructed the new generator were: T. E. Allibone, F. S. Edwards and D. B. MacKenzie.

THAT all neutrons do not have the same mass or weight is predicted by Dr. A. v. Grosse, of the Kent Chemical Laboratory, University of Chicago, in a communication to *The Physical Review*. Electrons, or beta rays, given off from a disintegrating atomic heart, do not always have the same energies. This has worried physicists so much that some have suggested that the principle of conservation of energy be abandoned in considering the emission or capture of electrons in the atomic nucleus. Dr. Grosse suggests instead that the masses of all neutrons are not identical, but vary according to the energies of the beta rays that are actually observed. The neutron was the atomic building block, similar to the proton or hydrogen atom heart except for its electrical neutrality, which was discovered by Dr. J. Chadwick, at Cambridge, England, last year.

LITHIUM atoms have been disintegrated by bombardment with streams of protons or positive electrical particles at relatively low voltage, by three German physicists at the Institute for Experimental Physics at Kiel, Drs. H. Rausch von Traubenberg, A. Eckardt and R. Gebauer. They sought the threshold, or point of lowest electrical energy, at which the atom-breaking phenomenon would take place. When first performed last year by Drs. J. D. Cockcroft and E. T. S. Walton at Cambridge University, the energy used amounted to 600,000 volts. With a specially constructed apparatus the workers at Kiel obtained definitely detectable atomic breakdowns with an input of only 29,000 volts, less than a twentieth of the energy used in the English experiments. The work is summarized in a report to *Die Naturwissenschaften*.

ENOUGH iodine to supply the entire present American market could be produced at the end of a year's expansion program of a new chemical plant recently established at Los Angeles to extract this widely used element from California oil-well brines. Its present production is several hundred pounds of iodine a day, but it can be expanded to produce 350 tons a year, the present American consumption, if this should prove necessary. The plant has already wrecked the monopoly price formerly maintained by the Chilean nitrate corporation, which obtained iodine as a by-product of its fertilizer production. Some months ago the Chilean corporation cut its former price of $4 a pound to $3; within the past few weeks a further cut was made to the present prevailing price of $1.95 a pound. The new American firm has met all its rival's price cuts, and it is reported they are able to face any price competition which Chilean iodine may offer.

VIGILANT sentinels of science on all the borders of the United States stopped over twelve thousand invasions of American territory by insect pests and fungus diseases of plants in a single year. A detailed report of the period covered—July 1, 1931, to June 30, 1932—has been published by the U. S. Department of Agriculture. At least eight distinct species of fruit flies were stopped, as stowaways on a long list of fruits and vegetables from an even longer list of foreign ports. Most prominent among them was the Mediterranean fruit fly, whose outbreak a few years ago in Florida caused a serious situation and was suppressed only with much labor and expense. This world-distributed pest was detected on fruits from Algeria, France, the Azores, Bermuda, Hawaii, Italy, Spain and Venezuela.

SCIENCE NEWS

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IRREGULAR DISTRIBUTION OF DISTANT GALAXIES IN EVOLUTIONARY GROUPS

THE distant galaxies, those clouds of stars far beyond our own galactic system, which includes the sun and all the stars that we ordinarily observe in the sky, seem to be irregularly distributed in space. This is the opinion expressed by Dr. Harlow Shapley, director of the Harvard College Observatory, in an Observatory Bulletin that has just appeared. Furthermore, he suggests, these irregularities are the result of some evolutionary process in the higher system of which the galaxies themselves are the units.

These galaxies appear on the photographs taken through great telescopes as faint nebulae, and they show in greatest numbers in regions far from the Milky Way, for there the stars in our own galaxy, and the associated dark matter, obscure them. But even in the regions where they are most numerous, there is considerable irregularity in their distribution. The question was whether or not this is real, or whether they too are partly hidden by dark material in space. The nebulae studied by Dr. Shapley are those nearer than 25 megaparsecs. A megaparsec is the biggest unit of distance employed by astronomers. It is the distance that a beam of light will travel in 3,260,000 years.

Dr. Shapley's research was to determine whether there was any correlation between the distribution of these galaxies, and that of the faint stars. These stars are presumably the most distant in our own Milky Way system, and so, if the sparseness of the galaxies was the result of dark matter in our own system, the stars should be affected similarly. However, he finds that there is no correlation whatever. The stars are also distributed very irregularly, but in some regions where they are thick, the galaxies are very scarce, and *vice versa*. There are other cases where the two happen to be most numerous in the same regions.

"From these simple tests," states Dr. Shapley, "it appears that the distribution of external galaxies is wholly independent of the distribution of faint stars, and we deduce therefrom that if obscuring matter is involved it is external to our own galactic system. A much more reasonable assumption, of course, is that the irregularities in apparent distribution are real and indicate groupings of external galaxies. The irregularities are obviously too pronounced to be attributed to chance; they are rather a demonstration of evolutionary tendencies in the metagalactic system."

This idea would fit in with earlier researches by Dr. Shapley which indicated that distant space is reasonably transparent, in that it is not filled with a sort of mist. This was shown by a study of the relation of the size of the galaxies to their surface brightness. If space is transparent, the distant ones would be faint merely because they seem smaller than those which are nearer. If space were filled with some sort of obscuring fog, however, the brightness of a certain area of the distant galaxies would be less than that of a corresponding area in a nearer one. However, he found that the average surface brightness was fairly constant regardless of distance. If there were actual dark clouds that obscured all the light if they obscured any, the surface brightness would not be affected. But in the absence of any evidence that there are such clouds beyond our galaxy, it is more reasonable to assume, as Dr. Shapley suggests, that the irregularities are real.

EOANTHROPUS AND NEANDERTHAL MAN

DR. HANS WEINERT, anthropologist at the Kaiser Wilhelm Institute, Berlin, has examined the original specimens of Eoanthropus, the Dawn Man of Piltdown, England, and is convinced that Eoanthropus is more human than Neanderthal Man and that he is probably not as old as he has been considered by earlier investigators.

Dr. Weinert's argument turns to a considerable extent on the Dawn Man's teeth and lower jaw, which were found separately from the fragments of the upper skull. These have hitherto been considered to be definitely ape-like, contrasting strongly with the massive, but just as definitely human cranium. So great has this contrast appeared to earlier workers that some of them would not believe that jaw and cranium belonged to the same being, but held that the skull was a man's, the jaw an ape's. But the German investigator finds that the teeth are human after all, and is of the opinion that the jaw and skull do belong together.

The Eoanthropus fossils consist of two fragmentary crania, half of a lower jaw containing two molars, a loose eye tooth and a loose molar. The pieces of one skull, the jawbone and the loose eye tooth were found in a gravel pit at Piltdown, Sussex, between 1909 and 1913; the pieces of the second skull and the loose molar in the same neighborhood, at a distance of about two miles, in 1915. In the gravel stratum were many bones of extinct animals, including mastodon, hippopotamus and rhinoceros. These animals were identified as being of early Ice Age date, so that the human fossils were assumed to be of equal antiquity, although it was recognized that the gravel deposit, bones and all, might be secondary, that is, washed in from elsewhere.

Now, Dr. Weinert states, the English investigators agree with him in regarding the animal remains as older than the human fossils, so that the great antiquity heretofore assigned to Eoanthropus is at least open to question.

As for the likelihood that the skull and the teeth belong to two different creatures, he points out that the coincidence would have to be twice repeated, since the loose molar was found near the second group of skull fragments, just as the jawbone-piece and the loose eye tooth were found near the first. He feels that the probability of the pieces really belonging to each other is

greater than the chances of a double coincidence of the remains of the same kind of man and the same kind of ape being found in the same place. As for the apelikeness of the jaw teeth, he says, "the lower jaw is not so pronouncedly anthropoid as has been assumed; the teeth are human; what appears apelike about them can be found in other human teeth as well."

Stating that he intends soon to publish his detailed findings in a leading German anthropological journal, he adds, "If my work finds acceptance, then Eoanthropus is no 'Anthropus' and no ape, but a 'Homo' (man), indeed more 'Homo'—and therefore more truly human—than the Neanderthaler."

Dr. Weinert's preliminary conclusions are contained in a communication to *Forschungen und Fortschritte.*

CLIMATIC FACTORS IN THE DEVELOPMENT OF CIVILIZATION IN RUSSIA

RUSSIA'S sprint to overtake and pass the western cultures, under the spur of Soviet leadership, is foredoomed to failure, in the opinion of Dr. Ellsworth Huntington, research associate in geography at Yale University. In an address before the Franklin Institute, he based his prediction on the depressing effects of Russia's dry, cold, monotonous winters, as contrasted with the more varied and stimulating climates of western Europe and the northeastern United States. January and February, called "Russia's best generals" in the days of the Napoleonic invasion, are according to this view also Russia's worst enemies.

Dr. Huntington has for many years maintained a thesis of the dominant importance of climatic factors in the development of civilizations, often in the face of strong disagreement on the part of other scientists.

"According to my theory Russia would be expected to be more inert and less progressive than countries like Germany, France and England, which surround the North Sea," said Dr. Huntington. "This does not preclude the rise of men of extraordinary genius and energy, but it does mean that we should expect such men to be poorly supported in their efforts at progress. The vital point is whether a new social system, led by great organizers but imposed on people under an environment with cold winters of depressing dryness, low temperatures and lack of variability, can cause Russia to rise above the level that would be expected on the basis of its climate.

"Thus far nothing of the kind has happened. In spite of the five-year plan industry in Russia has not quite reached the level that it would normally have reached if there had been no war and revolution.

"This may seem like an extraordinary statement. Nevertheless, the curves of production of coal, iron, petroleum, cotton goods, sugar and other commodities all show that if the rate of progress that prevailed from 1880 to 1913 had continued, Russia would to-day be better off industrially than is actually the case.

"In the same way, although a vast number of Russians have learned to read, the real question is what proportion are really doing any intelligent reading, and how this compares with the proportion in Germany, for example, or with the proportion that would be thus reading if the pre-war rate of progress had continued."

Dr. Huntington's remarks on Russia were made in illustration of his general theme, that climate operates through three main factors in influencing the development of human cultures. First in importance is the mean temperature. Human beings do their best physical and mental work at temperatures around 63 degrees Fahrenheit, and too wide a departure in either direction is depressing. Furthermore, the plants and animals man has domesticated find their optimum temperatures near man's own.

Contrary to common assumption, Dr. Huntington continued, high humidity of the air is beneficial, not harmful, at the moderate temperatures best for human life; it is bad only at excessive temperatures. Finally, a variable climate is more favorable for the development of initiative and energy than is an equable one. Thus the moderately stormy American climate is better than the monotonous cold of the Russian winter, or the monotonous warmth of the tropics.

REFORESTING OF SLOPES TO CONSERVE WATER SUPPLY

PRESIDENT-ELECT ROOSEVELT'S project for reforesting the uplands of the Tennessee Valley will arouse interest among foresters for more than its possibilities toward a restoration of the nation's timber supply. Long before any wood can be harvested from the new forests, they will have begun to pay for themselves in the improvement of the region's water supply and in the checking of the land's deterioration through erosion.

The significance of reforestation in the conservation and regulation of water was exhaustively discussed at a recent meeting of the Society of American Foresters, by Director C. L. Forsling, of the Intermountain Forest and Range Experiment Station at Ogden, Utah. Although Mr. Forsling's immediate work is in the West, the general principles he discussed are regarded as valid for any region. His discussion will be reported in detail in the forthcoming issue of *The Journal of Forestry.*

Denudation of upland forest areas brings in its train a whole chain of evils, as outlined by Mr. Forsling. The ground loses the sponginess given to it by the dead leaves and forest litter, and hence will not hold the water and let it trickle down into the soil to the underground run-off channels. Instead, the run-off goes along the surface, washing away the valuable top soil, choking streams with floods and then as suddenly leaving them almost empty, clogging irrigation and water-power conduits, fouling domestic water supplies, killing fish and leaving loads of unwanted silt on bottom lands after inundations.

The destruction of tree cover, especially of conifers, also permits a more rapid melting of snow in spring, wasting water that would be valuable later and causing early floods. In the special case of the Tennessee River, which flows northward into the Ohio River near its mouth, these spring floods can be especially damaging, because the snow melts off its upper watershed in the

South while it is still winter in the lower Ohio Valley, thereby increasing the suffering of the people driven out of their homes into the cold of late February or early March.

All the evils of denudation have been operative in the Tennessee Valley and in other river valleys in the East and Southeast for over a century, so that much of the farm land has already lost its value as such and must soon be abandoned. Mr. Forsling called attention to the Little Pigeon Creek Valley in Indiana, where Abraham Lincoln's father cleared virgin timber to make a farm in 1816. The farms of this region, he said, are already being abandoned, their fertility exhausted or their top soil eroded away.

The project of President-elect Roosevelt promises to be an experiment in the rehabilitation of both forest and farm lands on a scale hitherto undreamed of, and for this reason foresters and water conservation engineers will watch its progress with intense interest.

THE BALD EAGLE

THE bald eagle, hailed in a thousand patriotic orations as America's bird of freedom, is very much in need of protection if it is not to be exterminated from the land. Only five states of the forty-eight grant it legal immunity by special act, and there is no federal legislation whatever for its protection, notwithstanding the fact that it is the official emblem of the United States of America.

So declares the National Association of Audubon Societies, which defends the bird against charges commonly made to its disparagement. The bald eagle's occasional choice of dead fish, which sometimes replaces fresh fish in its diet, has been used as a slur on its character, but this trait, the association points out, is actually in the eagle's favor, making it useful as a cleaner-up of beaches and stream-banks. Scientific records show that the bald eagle does little harm as a predator. It belongs to a class of large and picturesque birds that have been for many years the object of an ignorant prejudice although few do more harm than good, while the great majority are either harmless or positively beneficial in their food habits.

The bald eagle, especially, has been too long misunderstood and misrepresented. Most people fail to realize the character of the actual eagle, but carry in their minds an impression of a false and imaginary bird, a fabulous creature that is an angel to politicians, a devil to game wardens and a mythical feathered ogre out of "Grimm's Fairy Tales" to the rest of us.

Franklin's tirade against the bald eagle doubtless was based on pique, since Congress refused to adopt his own candidate, the wild turkey, as the emblematic national bird. Audubon, in quoting Franklin, was evidently striving to paint a colorful, well-rounded portrait, for his account likewise contains a classic appreciation of the noble bird's many admirable points.

ITEMS

BY allowing the heart of a helium atom to "tune in" on the heart of an aluminum atom, creating in it a sympathetic vibration, physicists of the Carnegie Institution's department of terrestrial magnetism at Washington have smashed the aluminum heart or nucleus. This achievement by Dr. L. R. Hafstad was announced by Dr. M. A. Tuve in a lecture before the Franklin Institute. The first experiments on the resonance smashing or disintegration of atoms were performed by Dr. M. Pose in Germany, and Drs. Hafstad and Tuve have now confirmed this work and carried it further. It is found that when the attacking alpha particle or wave, which is the helium heart, has the proper energy it penetrates the other atom's nucleus. In this case, the alpha particles of mass four from radium joined with aluminum of mass 27 and formed silicon of mass 30 and released hydrogen of mass one in the form of a proton or wave-particle of positive electricity. Using high voltage apparatus generating 600,000 volts, Drs. Tuve, Hafstad and O. Dahl repeated the experiments of Cockcroft and Walton at Cambridge, England. Hydrogen hearts, or protons, were flung at lithium and boron and helium obtained from the disintegration.

SOME seventy years ago Alexander Lagerman, one of Sweden's greatest inventors, was penniless and lacked the means for completing his foremost invention, the automatic match-making machine, which is one of the principal causes of Sweden's supremacy in the match industry. Shortly afterwards the Swedish Academy of Science recognized his merits and gave him a sum of 3,000 kronor to enable him to finish his invention. Lagerman, who died twenty-eight years ago, in his will donated a fund for the benefit of inventors in need of economic support. A few days ago eleven young Swedish inventors among some sixty applicants received varying sums from the Lagerman Fund to enable them to complete their promising inventions. These include an accumulating fuel pump for Diesel engines, a new protective device for railway crossings, household and agricultural appliances, etc.

CATERPILLARS can hear. They hear sounds audible to human ears, according to a report read before the American Society of Zoologists by Dr. D. E. Minnich, of the University of Minnesota, who outlined experiments demonstrating his point. He held tuning-forks of several pitches within the range of the middle piano keyboard over a sound box in which were caterpillars of fourteen different species. When he struck the forks the caterpillars served notice that they heard, either by stopping their movements or by vigorously contracting their longitudinal muscles.

"GEOGRAPHY 36." This is the prosaic title of a new course in aerial photography offered during the second half of the present school year at Harvard University. The instruction will be under the direction of four Army officers, Captain A. W. Stevens, Captain D. M. Reeves, Captain B. C. Hill and Lieutenant J. F. Phillips, on leave from Wright Field, Dayton, for the purpose. The latest photographic equipment, including a five-lens camera, will be used and plans are being considered for actual aerial work by students toward the end of the course. The course is open to qualified undergraduate students as well as graduates.

SCIENCE NEWS

Science Service, Washington, D. C.

FREE POSITIVE ELECTRONS

"POSITRON" is the name with which the newly discovered positive electron will be christened by its discoverer, Dr. Carl D. Anderson, of the California Institute of Technology, Pasadena, as soon as the existence of the free positive electron becomes fully established. Dr. Anderson announced in SCIENCE last September the existence of the positive electron from cosmic ray studies, and experiments in Cavendish Laboratory, Cambridge, have just confirmed his work.

When the London correspondent of Science Service cabled the news of the confirmation by the British physicists, the news was specially relayed by telegraph to Dr. Anderson with the suggestion: "Why not christen your new particle 'positron'?"

"With regard to your suggestion," Dr. Anderson wired in reply, "we have already discussed here negatron and positron.

"Historically and derivatively the word, electron, denotes the unit charge, positive or negative, without any reference to the associated mass. The discovery that there exists a positive charge which, like the free negative electron, is unassociated with any mass of atomic magnitude, requires the introduction of a new term to distinguish it from the proton which is used to denote the positive electron associated with the mass of the atom of hydrogen. We have been discussing in the laboratory for some months past the desirability of calling the free positive electron, positron, and then using the similar contraction, negatron, for the free negative electron. This makes a logical and systematic notation which should be introduced if and as soon as the existence of the free positive electron becomes established.

"If the observations obtained here, part of which are already published, are actually due to positrons then we have new experimental evidence that in passing through matter positrons lose energy more rapidly than do negatrons."

The demonstration of the existence of a positive electron, as a fundamental particle of matter, positively charged but with the mass of the familiar negative electron, throws atomic structure theory into at least a momentary state of confusion. And since the positive electron was found in cosmic rays it may prove to be helpful in explaining the nature of this radiation.

Physicists are presented with the fourth of the fundamental particles of matter or bricks out of which atoms might be built. Two years ago there were only two, the positive particle, or proton, and the negative particle, or electron. In 1931, Dr. J. Chadwick in the Cavendish Laboratory of the University of Cambridge forged the last link in the chain of experimental evidence for the reality of the neutron, the close combination of electron and proton that carries no electrical charge. Now out of the same famous laboratory, presided over by Lord Rutherford of Nelson, has come the demonstration of the reality of the positive electron, confirming the suggestion issued last September by Dr. Carl D. Anderson as the result of cosmic ray track photography in Dr. R. A. Millikan's laboratory at the California Institute of Technology.

WATSON DAVIS

REPORTING EARTHQUAKES

CHINA'S Christmas earthquake disaster, whose 70,000 deaths in Kansu Province are just being reported by cable, after the news had slowly filtered out of the interior, sent its own reports by much faster methods, and they were read and correctly interpreted by scientists on the day of the catastrophe itself.

Within a few hours after the earthquake occurred, eight seismological stations in widely separated parts of the world wired and radioed the facts of their instrumental records to Science Service. Investigators at the U. S. Coast and Geodetic Survey interpreted the data, and stated that they indicated a "very severe earthquake that was probably extremely destructive to life and property" in the interior of China. The latitude and longitude as thus calculated correspond exactly with the locations now being reported by cable.

This is the second time that a disastrous earthquake in that same region has sent its own report, via the sensitive instrument in seismological observatories, weeks ahead of the delayed cable news. On May 22, 1927, an even greater catastrophe, in which a hundred thousand Chinese perished, occurred in Kansu, and within eighteen hours its location had been determined and the statement made that loss of life and property would probably be very heavy. At the end of July, a missionary priest finally found his way through a ruined and bandit-infested region to a telegraph wire and sent the first verbal confirmation of the scientists' prediction.

Similar "beats" have been scored by scientists and seismographs over reporters and telegraphs in several other notable earthquakes during recent years. Data for these reports are gathered by Science Service and interpreted by the U. S. Coast and Geodetic Survey and the Jesuit Seismological Association, acting in cooperation with many seismological observatories in universities and other institutions in the United States and foreign countries.

In the case of the Chinese quake, the first wave was recorded on the nearest reporting seismograph, that of the Philippine Government Observatory at Manila, 6.5 minutes after the quake started in China. The second wave arrived 10.9 minutes after the shock. The difference in time between these two records indicated to scientists of the U. S. Coast and Geodetic Survey that the quake was about 2,220 miles from Manila. Similar time gaps were interpreted to signify distances of 4,200 miles from Strasbourg, in Alsace; 4,470 miles from West Bromwich, near London; 7,020 miles from the headquarters of the Jesuit Seismological Association in St. Louis, Mo., and 8,250 miles from the U. S. Coast and Geodetic

Survey observatory in San Juan, Puerto Rico. Similar reports were received from Tucson, Arizona, and the University of Vermont, Burlington, Vt. All the data were relayed through Science Service, which acted as a clearing station.

THE PREVENTION OF RANCIDITY BY MALEIC ACID

MALEIC acid, a cheaply and easily produced synthetic compound, has been found to be a good thing to add to edible fats and oils to keep them from getting rancid. Dr. G. R. Greenbank, of the U. S. Department of Agriculture, who made the discovery, has applied for a public service patent on its use for this and similar purposes, which it is expected will be granted soon. Under such a patent, the product can be used freely by anybody, and no one can establish a monopoly.

Dr. Greenbank was led to his discovery by a project in chemical research, with the object of finding why some oils and fats kept naturally better than others. He did not succeed in learning this, but did learn that the natural "better keepers" had extremely minute quantities of unidentified organic acids in them.

Then he tried adding acids of known composition to oils and fats, and soon found that maleic acid, added in a proportion of one part to ten thousand of the oils to be preserved, would enable it to stand without turning rancid for about three times as long as untreated samples of the same oils. The better the quality of the oil the longer it would be preserved by the maleic acid; the best oils had their natural life extended five times instead of the average three.

Dr. Greenbank has tried this method on many fats and oils used as food and in the industries, including butterfat, butter, lard and the oils of cottonseed, peanuts, corn and sesame. He has also tried it on such food products as milk powder and pie-crust, and he believes it will be useful in the cereal industries.

The chemistry of maleic acid's efficiency in preventing rancidity is not yet known. Dr. Greenbank thinks it possible, however, that it operates by stopping the formation of peroxides, which are intermediate steps in the respirational-digestive processes of the bacteria and other fermentive organisms that oxidize fats and oils, thereby splitting off the acids that give them the rancid odors.

Maleic acid is chemically related to malic acid, one of the mild acids found in apples and other fruits. It can be made from malic acid, though in commercial practise it is obtained synthetically in other ways. At present it is made by the chemical firms manufacturing photographic reagents, who make it so cheaply that they can sell it for a few cents an ounce.

ITEMS

A COMET that may become visible to the unaided eye was discovered early Thursday, February 16, in the northern evening sky by Leslie C. Peltier, an amateur astronomer of Delphos, Ohio, the Harvard College Observatory has been informed. It is at present eighth magnitude and sufficiently bright to be visible through small telescopes or high-powered field glasses. It lies between the constellations of Cepheus and Cassiopeia in the region of the Milky Way and it is moving southeastward. Further observations may be expected to show whether the comet is a newcomer to the heavens or an old comet returning to the vicinity of the sun. Mr. Peltier is a veteran comet discoverer. He reports the astronomical position of his latest discovery as right ascension 22 hours 48 minutes and north declination 62 degrees.

FOSSIL bones of a forty-foot plesiosaur, the largest and most complete specimen ever found in Australia, have been brought back to the Harvard Museum of Comparative Zoology by William E. Schevill, who has recently returned from an eighteen-months' expedition to that country. The bones are now being examined and prepared for permanent mounting.

CANCER will soon be treated at Mercy Hospital, Chicago, with a giant x-ray tube, with a voltage of 800,000 and a radiation output equivalent to radium worth $75,000,000. The new tube is about to be shipped from the General Electric laboratories, Schenectady, New York. The new 800,000-volt tube has several times the energy rating of the cancer-treating tube installed about two years ago in Memorial Hospital, New York. The tube itself is 14 feet long and it is being installed in such a manner as to assure the comfort and safety of patients and the hospital staff.

FISH livers have a new use—as treatment for pernicious anemia. This is announced by Professor L. S. P. Davidson, of the University of Aberdeen, in a report to the *British Medical Journal*. Professor Davidson found that an extract from livers of cod, haddock and whiting is effective in treating pernicious anemia. Beef liver is now widely used for this purpose.

"LACE CRABS," strange, delicately-constructed fossil creatures that lived in the primal seas half a billion years ago, may have been merely the "soft-shell" stages of trilobites, extinct relatives of lobsters and crayfish that dominated the waters of that long-gone epoch. This new solution for an old riddle of geology has been suggested by Dr. Rudolf Ruedemann, of the New York State Museum. Working with a specially constructed microscope, Dr. Ruedemann has found evidence that the "lace crabs" had shed an outer shell, as lobsters and crabs shed their shells to-day. In this "soft-shell" stage they looked like creatures of an entirely different order, with wide-apart eyes on their unprotected heads, and the delicate lacy limbs that have given this fossil group its name. The principal deposits of "lace crabs" have been found in fine-grained shales, hardened out of the mud into which the unprotected moulting trilobites settled for shelter while their new shells were forming, and where many of them were trapped and killed by pockets of water over-charged with carbonic acid. The "lace crabs" were first described by the late Dr. Charles D. Walcott, secretary of the Smithsonian Institution. Dr. Ruedemann's suggestion that they were "soft-shell" trilobites is set forth in a recent Smithsonian publication.

SCIENCE NEWS

Science Service, Washington, D. C.

INAUGURATION DAY

WHATEVER the uncertainties of Washington weather may bring Mr. Roosevelt's inauguration as president, he can look forward with reasonable assurance to January 20, 1937, for a day of settled weather. On that day, when, according to the Twentieth Amendment, future presidential inaugurations will take place, he can probably begin his second term (if the fortunes of politics so ordain) under kindlier skies than Washington usually provides around the stormy beginning of March.

An examination of Weather Bureau records for the past ten inauguration years, from Cleveland's second, in 1893, to Hoover's in 1929, shows that only one of the January twentieths in that time had any measurable snow or rain. That was the first of the series, January 20, 1893, which was a chilly, rainy day with a little snow. Contrasting with this, the March fourths during the same series provided rain or snow seven times out of ten chances. Cleveland's second inaugural took place in a snowstorm, and Taft rode to the White House through a veritable blizzard that dumped nearly ten inches of snow on the streets of the capital. The most recent inauguration day, Mr. Hoover's in 1929, brought a cold, disagreeable rain that began just before the oath of office was administered and lasted all the rest of the day.

January 20 inaugurations not only promise fairer, more settled weather, if past performance can be construed as promise, but they will probably not bring severe cold. The Weather Bureau's records for January 20 in all inauguration years from 1892 to 1929 show mean temperatures above the freezing mark on all but three of the days. Those were January 20, 1893, with 20 degrees; January 20, 1897, with 30 degrees, and January 20, 1901, with 25 degrees. The highest mean temperature of the series was January 20, 1913 (Wilson's first inaugural), with 49 degrees. Since the principal ceremonies of the inauguration usually take place during the warmest part of the day, the mean temperature can be expected to be bettered considerably in most years.

Weather probabilities for March 4, the last inauguration day under the old dispensation, are totally unpredictable as yet, according to Weather Bureau officials. During the past few weeks changes have been taking place so rapidly that not even the most tentative guess can be made of possible tendencies. It is possible to say only that the first week of March is an unsettled period, when anything may happen.

SECRETARY OF AGRICULTURE WALLACE

HENRY A. WALLACE, who is to be Secretary of Agriculture in Mr. Roosevelt's cabinet, brings to his office the combination of practical farming and equally practical science that has become a tradition of the Department of Agriculture. Born to the editorship of the great farm paper, *Wallace's Farmer*, which his grandfather had founded and his father continued, Henry Wallace was given the best training that the Iowa State College at Ames afforded. He came out with his baccalaureate in science in 1910, both a "dirt farmer" and a "dirt scientist."

Among other things, he calls himself an agronomist, which means a scientist of field crops. His outstanding agronomical work, however, has been in plant breeding, specifically in corn breeding. Before his time, Dr. George H. Shull, now at Princeton University, had applied the principles of Mendel to the production of "pure lines" in corn, isolating desirable characters in specially developed strains of plants, even though in doing so he made them unpromising runts in all other respects. Then he recombined his "pure lines" at will to build up a mosaic of characters of exactly the kind he wanted.

Dr. Shull had become interested in other plants and let his corn work drop. Henry Wallace took it up and carried it out on a much larger scale, producing numerous new strains of corn on his farms around Des Moines. The best of these high-yielding offspring of crossed "pure lines" have revolutionized corn production in the Midwest. Paul DeKruif, in his book, "Hunger Fighters," has brilliantly summarized the work of Shull and Wallace.

But corn breeding, and botany applied to the problems of the cornfield, are by no means all of Henry Wallace's scientific accomplishments. He has given much thought to the economic problems of the farmer as well, building up a considerable reputation as an agricultural economist. And since both plant breeding and economics require the expert handling of numerical data, he has become a statistician, as much at home behind a calculating machine as he is behind his editor's desk or among his experimental corn-rows.

The titles of his three published books reflect his threefold scientific interest: "Agricultural Prices," published in 1920; "Corn and Corn Growing," in 1923, and "Correlation and Machine Calculation," in 1924.

THE NEUTRON

THE neutron is not a mere close combination of electron and proton acting like a fundamental particle of a nature, but it actually is an elementary particle itself.

This is the conclusion of Dr. Franz N. D. Kurie, twenty-six-year-old research fellow in the Sloane Physics Laboratory, Yale, after experiments on atomic collisions in which neutrons take part.

When Dr. J. Chadwick, of Cambridge, England, last year discovered the neutron, it was held that it is an electrically neutral combination of the more familiar electron and proton.

By measuring the angles at which protons are ejected from nitrogen atoms, Dr. Kurie found that the neutron does not conform to the configuration described by physicists. Two views of neutrons have been held: that it is either like a dumbbell, with a positive and negative

charge separated by a small distance with their effects cancelled; or is like an onion, with a sphere of one kind of electricity surrounded by a layer of the other kind so that again the charge is cancelled.

The direction in which either of these models of the neutron would eject protons has been calculated, and it has been found that the dumbbell type should eject them all perpendicularly to its own path, while the onion type would eject some straight ahead, with about ten times as many being thrown off perpendicularly.

Dr. Kurie's experiments with neutrons did not confirm either of these theories and he believes that the neutron is not built according to either of the accepted models. He concludes that the neutron is an elementary particle possessing an individuality and discrete qualities as do the electron and proton.

Dr. Kurie performed his experiments with a Wilson cloud chamber, a device which makes visible the track of a swift-moving proton somewhat as an aviator can see the wake of a boat which is itself too small to be seen.

Of the three thousand neutrons which pour throughout the chamber each second, but which can not be seen since they do not disturb the molecules of the gas within, one neutron occasionally hits a proton, the nucleus of a nitrogen atom. This proton, carrying an electrical charge, disturbs the molecules in the chamber and leaves a track which Dr. Kurie photographed with a special camera which he perfected while obtaining his doctorate at Yale University under the direction of Professor Alois F. Kovarik. The angle at which the proton has been ejected can thus be measured since the direction in which the neutrons are moving is known.

RAT-CATCHING CATS

SELECTIVE breeding of rat-catching cats is the best way to keep down rats in the opinion of Dr. Adrian Loir, medical officer of the port of Le Havre, France.

Dr. Loir's interest in the subjects of rats and cats arises from the fact that rats may spread bubonic plague. France, like other countries, keeps hourly guard on her ports lest plague-stricken rats, with infected fleas ready to pass on this scourge to human beings, gain entrance.

Dr. Loir recently reported the success of his cat breeding to the French Academy of Medicine, the most important forum of medical science in France. He discoursed before this gathering of learned men on such an apparently frivolous topic as his cat, Poupette, and another rejoicing in the name of Lico.

Lico is a champion and is first holder for 1930 of the cup of the Rat-catching Cat Club of Normandy. The Rat-catching Cat Club was founded by Dr. Loir, with its chief object the breeding of cats with a constant and intense craving for catching rats. Not all cats chase rats. Some establish a tacit neutrality pact with rats, with whom they may be seen in some streets at night, the one ignoring the other studiously. Such is not the case with Dr. Loir's cats, however.

In one dock area in Le Havre, in 1930, where as many as 145 rats were caught in only 8 days, there are now no more rats. Five rat-catching cats, one of whom is Lico's son, patrol this area which the rats of Le Havre have learned to dread more than the plague itself.

One day Herriot, formerly Prime Minister, paid a visit to Le Havre, where he was so impressed by Dr. Loir's initiative that he begged a cat of him for the benefit of the town of which he was mayor, Lyon. It seemed that the abattoirs of Lyon were overrun by rats. It was the story of Dick Whittington all over again.

As Dr. Loir told the story, the Mayor of Le Havre was not deaf to this appeal. Le Havre was to come to the rescue of Lyon. A special credit was opened to allow the director of the abattoirs to receive Le Havre's envoy with the necessary distinction. Her name was Poupette, and the litter of kittens to which she gave birth shortly after her arrival was a practical gesture indicative of her appreciation of the hospitality she had enjoyed. On November 24, 1932, the director of the abattoirs wrote: "I wish to tell you that the abattoir of Lyon is completely rid of rodents of every size."

BACTERIA-FERMENTED BEER

BEER made by the fermentive action of a special bacterial culture instead of the customary yeast, and drunk, bacteria and all, is an excellent remedy for disorders of the digestive organs as well as a palatable drink. So states Professor Paul Lindner, of the Berlin Agricultural College, who made the discovery in the course of an endeavor to determine the identity of "soma," the sacred drink of the ancient Persians and Indians. Professor Lindner's preliminary report is given in the German scientific weekly, *Forschungen und Fortschritte.*

"Soma" had long been supposed to be merely ordinary beer, with the addition of some kind of plant, not now identifiable with any certainty. But the health-giving properties of the brew are so lauded in the ancient literature that Professor Lindner suspected that the well-being induced by it was more than the ordinary pleasant delusion of a successful Bierabend.

He had for many years been familiar with the Mexican drink "aguamiel," made from the juice of the century plant, and sometimes called "milk of the green cow" because it was drunk by the Mexicans while it was still white with its active fermentation. He had discovered that the fermentive organism in this drink is not a wild yeast but a bacterium, which he called *Termobacterium mobile,* or for convenience simply Tm. The same organism has been found in other fermented drinks produced in the tropics, and where it is present it predominates to the exclusion of yeast.

Professor Lindner suspected that it was the bacteria rather than the beverages they produced that brought about the excellent digestive and assimilative health of the drinkers. To test this theory, he centrifuged out about a tablespoonful of the organisms from some fermented liquid and swallowed them "straight." They did have a most beneficial effect.

He then undertook scientifically controlled brewing, using Tm bacteria instead of yeast. He found that the products of such fermentation were pure ethyl alcohol with a very little lactic acid, but no fusel oil, supposed to be the prime cause of the "Katzenjammer" follow-

ing indiscreet indulgence in yeast-fermented beverages. For one thing, the bacteria apparently can not ferment malt sugar, but only glucose, and hence produce a beer of quite low alcoholic content, but high food value.

He induced a commercial brewery in Sweden and one in Vienna to produce bacteria-fermented beer on a moderately large scale, and with the cooperation of Dr. Leo Kaps, of the Wilhelmina Hospital in Vienna, tried it on a large number of patients. When given with the bacterial cloudiness still in it, the beer induced excellent conditions in the digestive tract. The same beer filtered, however, was merely an agreeable drink and had no therapeutic value.

ENERGY FROM COAL, OIL AND GAS

OIL and gas will have increasing use as energy sources in the United States and by 1950 they will account for nearly half of the expanded fuel requirements of the nation.

A forecast of the relationship between coal and petroleum in the future and a survey of future energy requirements was presented to the American Institute of Mining and Metallurgical Engineers meeting in New York by Professor W. Spencer Hutchinson, of the Massachusetts Institute of Technology, and August J. Breitenstein, Ashland, Pennsylvania, engineer.

In 1950 it is estimated that 499,500,000 tons of coal will be used, compared with 517,018,000 tons in 1930. The situation is reversed for petroleum, with 1,419,000,000 barrel consumption predicted for 1950 and 868,484,000 barrels consumed in 1930.

Total energy *per capita* demanded in the United States shows a consistent growth, the engineers were told, and it increased at a faster rate than the population. Chief sources of energy to-day are the mineral fuels, coal and petroleum, which between them account for more than 90 per cent. of the demand, with water-power supplying only 10 per cent.

A marked change has occurred in the relative proportion of energy obtained from coal and oil. Only 30 years ago 91 per cent. of the country's horsepower came from coal, and only 4 per cent. from oil and natural gas, but in 1930, horsepower from coal had dropped to 60 per cent. while the proportion furnished by oil and gas had risen to 31 per cent. By 1950 it is estimated that coal would furnish only 46 per cent. of the country's power, while 45 per cent. would come from oil and gas, and 8 per cent. from waterpower.

Consumption of coal in this country reached its zenith in 1917, with 6.08 tons *per capita*. From this year the decline was rapid. It was only 4.2 tons in 1930.

Other findings of the study by Professor Hutchinson and Mr. Breitenstein are:

Whereas, in 1930, the effective energy supply in the United States, expressed in trillions of British Thermal Units, was 9,031, it will have risen to 14,500 by 1950.

In 1930, the energy supply *per capita*, expressed in millions of British Thermal Units, was 73, while in 1950, it is expected to be 94.

Whereas, bituminous and anthracite coal accounted for 60.3 per cent. of the total energy derived in 1930, it will account for only 46.6 per cent. in 1950.

Petroleum and its natural products, including also natural gas and natural gas gasoline, will show a marked rise. Accounting for only 31.6 per cent. of the total energy derived in 1930, they will account for 45.3 per cent. in 1950.

Waterpower will account for exactly the same percentage of the total energy derived in 1950 as in 1930, namely, 8.1, although the energy applied by hydropower will be greater than in 1930.

ITEMS

THE earthquake that caused excitement and alarm in Peru on February 23 had its epicenter near the western boundary of Bolivia, according to a report of investigators for the U. S. Coast and Geodetic Survey made after examining seismological data telegraphically collected by *Science Service* from a number of American and Canadian observatories. The approximate location was given as 19 degrees south latitude, 68 degrees west longitude. Since the reports indicated a violent earthquake, destruction of property and loss of life may have occurred in case the epicenter happened to coincide with a populated region. Direct reports may not come out immediately, due to the lack of telegraph lines and other means of communication in the interior.

PELTIER'S comet, discovered by an Ohio amateur astronomer, will not become visible to the unaided eye. A parabolic orbit solution made at the University of California by Anderson and Wyse under the direction of Professor A. O. Leuschner shows that the comet approached closest to the earth on February 25 and that it was then only slightly brighter than when discovered. Its brightness will now decrease. The comet's orbit resembles that of certain other comets, but not closely enough to identify it as an old comet paying a return visit. The comet is ninth magnitude in brightness and it has a slight condensation but no stellar nucleus.

A NEW national monument has been set apart on the Grand Canyon of Arizona, about fifty miles down-river from the point in Grand Canyon National Park now most visited by tourists. The new area, which will be known as Grand Canyon National Monument, comprises a total of 392 square miles, and has one magnificent vantage-point from which one can look down on the Colorado, winding its way at the bottom like a silvery ribbon. From most points on the rim in the present Grand Canyon National Park the river is quite invisible. Another feature of the new National Monument is a volcanic cone, thrown up in some long-past time and now wholly extinct. It bears the imposing name of "Vulcan's Throne." National Monuments, as distinguished from National Parks, are areas which are either less accessible to the public or for one reason or another are not suitable for immediate development and administration on the regular National Park scale.

SCIENCE NEWS

Science Service, Washington, D. C.

MEASUREMENT OF THE SPECTRUM PHOTOGRAPHS OF STARS

THE radiometer has now been used to study the spectrum photographs of stars, which show their composition. This application has been made by Dr. Sinclair Smith and Olin C. Wilson, Jr., of the Mount Wilson Observatory.

The common form of radiometer, which was the invention of the great English physicist, Sir William Crookes, consists of four small vanes balanced on a pivot in a partially evacuated bulb. One side of each vane is polished, the other blackened, and the black side of one faces the polished side of the next. When heat radiation, either from the sun or an artificial source, falls on the vanes, they start moving in the direction of the polished sides. The reason for this is that the black side absorbs more of the radiation than the other, and is heated more. The molecules of the small amount of gas remaining in the bulb are constantly in motion. When they hit the warmer side, they bounce off with a greater kick than those hitting the polished side, and so they push the vanes around.

In the arrangement developed by the Mount Wilson scientists, two tiny vanes are used, suspended from a fiber of quartz. Thus they can not turn completely around, as they twist the fiber. To the upper part of the fiber is attached a small mirror. A beam of light falls on this mirror and is reflected to a moving photographic film. As a greater or less amount of radiation falls on the vanes, the fiber twists more or less, and the reflected spot of light moves back and forth, leaving a trace on the film.

The spectrum photographs to be studied are negatives, and show a series of parallel clear lines, of which the relative brightness and widths are significant, as well as their positions. To study them, a strong light is focused to a narrow line on the plate, which is then steadily moved by an electric motor. The light that passes through, and the heat that accompanies it, varies with the intensity of that part of the spectrum plate. This heat falls on the radiometer, and thus the moving spot of light reflected from the mirror traces on the film a record of the intensities of the spectral lines.

Such a device is called a registering spectrophotometer, and previous ones have used either thermocouples or photoelectric cells to detect the light changes. The former converts the heat into electric energy, while the latter makes a similar conversion of light. Dr. Smith states that the new device avoids the electrical difficulties accompanying each of these, and that it is more sensitive than the thermocouple. He also says that it is much simpler, and that many institutions might build one, though unable to afford the other and more expensive instruments.

COLLOID GOLD

GOLD dispersions in water, known to the ancients as "aurum potabile," have been purified here by a special method of "electrical decantation" and concentrated so as to contain up to six grams of gold per liter (a fifth of an ounce per quart).

Professor Wolfgang Pauli, of the Colloid Institute of the University of Vienna, who devised the method, has been able, by analyzing the concentrated pure sols, to identify the gold compounds which are present in small quantities in the usual gold sols and are needed to maintain the gold particles suspended in pseudo-solution in water.

These gold particles are extremely small—visible only with the aid of the ultra-microscope—and are maintained in constant "Brownian" motion by the bombardment of the surrounding water molecules. This alone would not be sufficient to prevent the particles of gold from coalescing. They are kept separate by the electric charge which causes them to repel one another.

The origin of this electric charge has been much discussed by colloid chemists during the last decades. Zsigmondy, one of the pioneers in this field of knowledge, maintained that the particles consist of pure gold, charged by adsorbed ions, that is, electrically charged atoms or groups of atoms attached to the surface of the gold particle. Pauli, on the other hand, brought forward the view that the surface of the gold is covered with a chemical compound of gold which breaks up or dissociates, giving positive ions to the surrounding water, while the complex iron ion with a negative charge remains attached to the gold particle. The compound in question, in the special case when the gold sol is prepared by passing electric sparks through electrodes immersed in water acidified with hydrochloric acid, has been shown to be the insoluble gold ("auro") hydrochloride which gives up its hydrogen ion to the water.

When the gold particles are coagulated by freezing, this auro-chloride passes into solution in the form of auri-chloride, with liberation of hydrochloric acid.

The new facts discovered by Professor Pauli are of value both theoretically and practically because they will enable chemists to foretell the behavior of many metallic colloids, which have already been used in therapy.

Colloid gold itself has been employed against alcoholism, a fact rendered common knowledge by the shortest "story of three generations" ever told.

"Gold mine, gold spoon, gold cure."

HEAVY WATER

PROFESSOR GILBERT N. LEWIS, of the University of California, has obtained by experiment pure water that is heavier than ordinary water and even denser than sea water. This extraordinary water has a specific gravity of 1.035, whereas normal water is the liquid upon which specific gravity measurements are based and therefore has a value of one.

More than one third of the hydrogen in the heavy water consists of the hydrogen isotope, of atomic weight approximately two, that was discovered in 1931. This variety of hydrogen is the same chemically, but is twice

as heavy as the more usual hydrogen atom. The heavy water, like ordinary water, consists of two hydrogen atoms combined with one oxygen atom, as expressed by the familiar formula, H_2O.

Heavy water was first produced at the U. S. Bureau of Standards in Washington last year, but Professor Lewis by using similar methods of manufacture has obtained a larger concentration of the heavy hydrogen isotope in the water and his heavy water is therefore heavier. The heavy water obtained at the University of California is 35,000 parts per million heavier than ordinary water, whereas the U. S. Bureau of Standards water is 1,400 parts per million heavier than normal.

Experiments showed that the University of California heavy water has a refractive index one tenth per cent. below that of ordinary water.

Professor Lewis used the method devised by Dr. E. W. Washburn, of the U. S. Bureau of Standards, and Professor Harold C. Urey, of Columbia University, of obtaining a concentration of the heavy hydrogen isotope. This depends upon the fact that the light weight hydrogen is given off in electrolysis of water before the double weight hydrogen, resulting in a concentration of heavier water.

CLIMATE CHANGES AND THE LAST GLACIAL PERIOD

EVEN those portions of the earth not covered by ice during glacial periods are indirectly influenced by the ice sheet. One of the rare instances where these influences could be detected was described by Professor William Morris Davis, visiting professor of geology from Harvard University, in a recent address at the California Institute of Technology.

The unusual locality was the Santa Monica mountains which rise out of the ocean immediately west of Los Angeles. There the effects of three successive glacial periods are visible. During these the sea receded and the steep cliffs which it wore from the mountains were left to be softened and filled in by land deposits. Meanwhile the land was rising, so that after the glacier withdrew the sea could not reach its old shore-line and consequently made new sharp cliffs at the lower level. This process was repeated twice.

It is estimated that during a glacial period the sea-level may sink thirty feet or more. Since the water removed from the sea forms ice on the continents and since these cover only about one fifth of the earth's surface, the ice layer must attain an average thickness of several hundred feet, even if it is spread over half the earth. The present sheet over Greenland is several thousand feet thick.

It is well known about how fast the land is rising in California; so from the difference in level between successive cliffs estimates can be made of the elapsed time between glaciers and since the last one. It turns out that the last one was quite recent in comparison with the interval between glacial periods. Professor Davis suggested that this may indicate that the earth will get warmer before it starts to cool again prior to the next glacier. The ice caps in the polar regions may disappear entirely and the poles may become useful and inhabited places.

Even though the average temperature of the earth need drop only about five degrees below the present average to bring on a glacial period, the consequent change in climate may be enormous. If the earth warms up enough to melt all glaciers now existing a remarkable change in climate all over the world would probably result. The advantage to science would be incalculable if we could take observations and make explorations in comfort in the polar regions.

CATCHING COLD AND BODY TEMPERATURE

WHETHER your body has a good heating system or not decides how easily you will take cold this spring, Dr. P. Schmidt, of Berlin, told a correspondent of the American Medical Association.

Dr. Schmidt had noticed for many years, that under the same circumstances, some people take cold much more easily than others. Now, using human beings as guinea-pigs, he has found out why.

Under his guidance a large number of persons exposed themselves to cold until they were thoroughly chilled. Then he measured their skin-temperature at several intervals until they had all returned to normal. He discovered that most of them regained normal skin temperature in a very short time. Some, however, were much slower to warm up to normal, and these, he discovered, were the ones who took cold from exposure.

The reason for this, says Dr. Schmidt, is the contraction of the blood-vessels and tissues at a low temperature. When contracted they are much less able to fight off germs and bacteria, just as an army of men when cramped into close quarters are unable to fight efficiently. So the persons whose temperature remained low over a long period of time gave the germs a chance to get the upper hand.

Only one tenth of all those tested had slow temperature reactions, which should mean that only one tenth of all people are naturally subject to colds. When you catch a cold, if you belong to the other nine tenths, it means that your heating system is temporarily out of order because of nervous or psychological conditions or because a prolonged unperceived draft has cooled off your bodily radiators. That last is why people have learned to think they catch cold from drafts. They do indeed, though indirectly.

Persons whose heating systems are ordinarily slow, says Dr. Schmidt, can speed them up by spending a great deal of time out of doors.

CHILDREN'S INVENTIONS

EVEN in this day of machine-made toys, children contrive tools and playthings strikingly like those made by primitive man in the Stone Age, Dr. Rosa Katz, of the psychological laboratory of the University of Rostock, Germany, found in a study of inventive genius as it appeared in her son Julius. She has reported her study to the *Journal of Genetic Psychology*.

Julius had read "Robinson Crusoe," and probably

got from that book the inspiration to be primitive and devise tools from available materials. He did not, however, get suggestions for the particular tools constructed; those developed from his needs of the moment.

While a goose was being dressed in the kitchen, Julius found that the "wind pipe" of the bird could be used as a water hose, and caused water to flow through it into a water basin. Later he blew through it and produced a hissing sound. He then stripped off the outer tissue, bored a hole through the side of the tube, and there was a primitive flute. It was possible to produce a flute from the wind-pipe only because it had first been used for water and thus made moist. Julius noticed this relationship.

From the same goose, Julius also made a primitive type of ornament. He noticed that the breast bone resembled somewhat a face, and immediately made of it a mask.

A suggestion of how primitive man may have bound up wounds in the absence of surgical gauze or muslin bandages is found in another invention of the boy. Julius was gathering up some wood shavings left in the house by a carpenter. In so doing he injured a finger. He sought out the thinnest of the shavings, moistened them, and with them bound up the wound.

Among the boy's other inventions were a milling stone in which he ground the kernels of hazelnuts, a flint scraper for removing bark, a tomahawk which during peaceful times served also as a hammer, a spear and a snail shell pendant for a feather garland. Snail-shells were used as pendants during the Stone Age.

But Julius's best achievement was probably his ax. He split the end of a stick previously made free from bark. He clamped a stone in the cleft and wound the shaft with a cord.

"There is no doubt that this was the essential appearance of the first ax swung by the human hand," according to Dr. Katz.

ITEMS

As the scattered members of Dr. Sven Hedin's Asiatic expedition gather in Peiping, to report their discoveries, alarm is beginning to be felt because Dr. Nils Ambolt, astronomer, has not arrived. Dr. Ambolt was expected in November, according to advices received in Berlin. He has been in northern Tibet, mapping unknown territory. It is feared that robbers may have attacked the party as it journeyed toward Peiping.

Blinded completely in one eye, with his other eye weakened, and with his hearing affected, Professor Gustave Aartovaara, of the Helsingfors Technical University, is a martyr to his search for a missing chemical element. In 1931, while engaged in the chemical concentration of the missing chemical element, 87, he was the victim of a laboratory explosion, the effects of which have prevented his continuance of research. To Professor Fred Allison, of the Alabama Polytechnic Institute, Professor Aartovaara sent specimens that he believed contained element 87 and Professor Allison detected this element by his magneto-optical method of analysis.

The most significant progress in the search for the cause of cancer is being made in laboratories where these glands are being studied, Dr. James Ewing, himself an eminent cancer authority and director of cancer research at Memorial Hospital, New York City, told members of the American Society for the Control of Cancer. Cancers of certain glands secrete the powerful hormones of these glands. A specific test for one group of cancers, those of the sex glands, has been devised as a result of discovering a hormone substance in all these cancers.

Two new isotopes of the element mercury have been discovered by Professor F. W. Aston, of the Cavendish Laboratory of the University of Cambridge. They have atomic weights 197 and 203. The detection was made through the obtaining of mass-spectra of mercury on new, very sensitive photographic plates. Isotopes 197 and 203 are estimated to be present only to the extent of one hundredth of one per cent. and six thousandths of one per cent., respectively. The mean atomic weight used by chemists is therefore affected only negligibly.

X-rays as intense as all the radium in the world could produce, and of a penetration and frequency equal to that of radium's gamma rays, have been produced from a new porcelain insulated, grounded anode x-ray tube of new design described to the American Physical Society by Cyrus A. Poole, of the Kelley-Koett-Manufacturing Co., Covington, Kentucky. Its design is an outgrowth of the work done by Professor C. C. Lauritsen at Pasadena, but embodies a transmission anode and is to be operated on direct current. The new tube operates on 800,000 volts furnished by a system of cascade electrical transformers and it is the first x-ray tube to operate on constant potential direct current at this high voltage.

Authorities in London are apprehensive of an outbreak of yellow fever in the Orient. At a meeting of the Ross Institute Advisory Board, Sir Malcolm Watson and others pointed out the grave danger now existing of this disease being spread from its focus in West Africa to East and South Africa by airplanes. Air travel has brought various parts of the vast African continent so close together that a person might become infected in West Africa with yellow fever and reach the eastern or southern part of the continent before the three- or four-day period necessary for the disease to appear in him. Airplanes may also convey mosquitoes, which may spread this disease. From East Africa it is a short jump to the Orient with its teeming millions who have never been exposed to yellow fever and consequently have probably no resistance to the disease. Quarantine regulations of air travel between South America, where the disease also has a focus, and the United States have been instituted by the U. S. Public Health Service. Similar regulations may be considered for air travel in Africa and between various African, Oriental and Australian points.

SCIENCE NEWS

Science Service, Washington, D. C.

THE SOUTHERN CALIFORNIA EARTHQUAKE

THE earthquake which shook southern California on the night of March 10 was not much larger than the one that eight years ago (June 29, 1925) damaged Santa Barbara, and the great 1906 San Francisco earthquake was much larger. It will rank, however, as one of California's major earthquakes. The probable origin of the quake, as determined from records at the Seismological Laboratory, Pasadena, was in the San Pedro Channel within the triangle formed by Point Firmin, Avalon on Catalina Island and Laguna Beach on the mainland.

Drs. H. O. Wood and Charles O. Richter, seismologists in charge of the cooperatively maintained earthquake laboratory which is set in solid rock back of Pasadena, explained to *Science Service:* "At just twenty seconds past 5:54 P. M. Friday our instruments began recording a moderately strong local shock which was sharply felt in the laboratory and which was evidently sufficient to cause damage near its source. The source appears to be sixty to seventy miles southeast of this laboratory, but because of peculiarities in the geological structure a precise distance can not yet be given. A large number of aftershocks have been recorded with very brief interruptions. Three or four of these have been stronger than the rest and have been barely felt at the laboratory. One or two hundred shocks have been recorded on the less sensitive instruments and it is probable that the more sensitive instruments will record a great many more." Six auxiliary seismologic stations placed at strategic points in California recorded the earth movements, and Drs. Wood and Richter explained that the precise location will not be possible before the receipt of these records.

This earthquake had been expected by seismologists for over a decade, although few definite public predictions had been issued in consideration of public fears. Geologists studying the crust of the earth and earthquake specialists operating sensitive recording instruments and listing the past history of southern California earth movements felt that conditions were ripe for a serious earth disturbance in that region. While residents of southern California had not in general recognized the existing earthquake danger, leading citizens and investigators cooperated to study the conditions.

Not for 78 years has the Los Angeles region suffered a large earthquake, although on July 8, 1929, a moderately severe shock was felt in the region surrounding Los Angeles and centering at Whittier. On June 21, 1920, the Inglewood earthquake occurred near Los Angeles and partially destroyed some weakly constructed buildings.

But the great earthquakes of Los Angeles recorded in history occurred in 1769, 1852 and 1855. Four violent shocks, on July 28, 1769, with strong aftershocks on five days following, are listed in the records of the California missions. This earthquake was probably strongest along San Pedro Bay near the present harbor of Los Angeles. This is the location of the present earthquake center. October and November, 1852, brought many earth shocks to the southern California of gold-rush days. October 26 saw eleven severe shocks at Los Angeles. On July 10, 1855, a quite severe earthquake did considerable damage in Los Angeles.

The ocean region off the San Pedro-Long Beach coast near Los Angeles lying between the coast and Catalina Island is known as San Pedro Channel. Geologists describe it as the San Pedro submarine fault zone and they know that this is an area where the mountains are growing. It is probable that the present earthquake was caused by an earth crustal adjustment in this area under the sea.

Professor Albert Einstein walked through the earthquake and did not notice it. He had just emerged from a California Institute of Technology building after attending his last seminar with local scientists before leaving for New York. Walking with Dr. Beno Gutenberg, the eminent authority on earthquakes, both he and Dr. Gutenberg were so absorbed that they said later they had not noticed the earthquake.

Buildings of the California Institute of Technology at Pasadena creaked and swayed greatly, but no damage was done to these structures especially designed to withstand earthquakes.

A NEW STRAIN OF BARLEY

"OUT of rough and black get smooth and white." This problem, reminiscent of one of the ancient riddles of the Sphinx, confronted Professor B. D. Leith, of the University of Wisconsin, at one stage of his endeavor to produce a new strain of barley that could be grown with profit by farmers in Wisconsin and other Grain Belt states.

It was not so impossible a task as it might sound, for he had already put the smooth and the white qualities into the genetic mixture where they were covered over by the rough and the black. All he had to do was plant his cross-bred grain and let the old reliable Mendelian mode of segregation do the work.

To go back to the beginning: Wisconsin farmers used to raise a strain of barley known as Oderbrucker. It was good barley, good for stock feed and good for the once-great Milwaukee brewing industry. But it had one fatal drawback: the beard on its heads was armed with innumerable little back-pointing barbs that would cause these bristly hairs to work their way through the threshermen's overalls, and made life so miserable for them that they finally rebelled at working with it at all. Also, it was subject to a destructive fungus disease known as stripe.

Professor Leith set to work to produce a hybrid barley that would have a smooth beard, and, if possible, be stripe-resistant, yet preserve the virtues of Oderbrucker barley—good white grain, high yield and stiff straw.

His first crosses, with other strains of domestic barley, were not very successful. But in 1917 a new smooth-bearded barley from Southeast Russia was brought in. It was black-grained, but that did not bother Professor Leith, for he was sure he could juggle the undesired color character out of the hybrid strains.

When he crossed Oderbrucker with the new Russian barley the first generation offspring were as undesirable as could be imagined, for the beard was as rough as in Oderbrucker and the grain was black as in the Russian barley. Here, then, was his Sphinx-riddle: out of black and rough to get smooth and white.

Professor Leith, like all good students of Mendelian behavior in heredity, knew that the blackness and roughness were "dominant" characters in any mixed strain, hiding but not destroying their "recessive" opposites, whiteness and smoothness. He knew also that such recessive characters segregate out when the hybrid first generation is inbred.

This he did, and the second generation barleys came out in approximately the following ratio: 9 rough and black, 3 rough and white, 3 smooth and black, 1 smooth and white. The last, a hybrid containing only recessives in its pairs of characters, was what he was hunting for; and he knew also that so long as it was inbred neither roughness nor blackness could reappear.

This smooth-white strain forms the basis of the barley strain now known as Wisconsin Barbless, Pedigree 38. In several years of practical crop growing by a large number of farmers, some of them outside the state, it has out-yielded Oderbrucker, resisted drought, and proved highly resistant to stripe, though not to other diseases. Most important of all, its smooth beard makes it possible to harvest and thresh the new barley without making life a burden for the farmer or the threshermen.

With an eye to the eventual return of beer, the owner of one of the most famous of the old-time Milwaukee breweries has made large-scale tests of the malting qualities of the new barley at his own expense, and reports that so far as its chemical make-up is concerned it is at least the equal of the best of the old barleys.

PETRIFICATION IN THE YELLOWSTONE NATIONAL PARK

TREE stumps now undergoing the process of petrification are an interesting sight in the Upper Geyser Basin, in Yellowstone National Park. Upper Geyser Basin is the general name for that portion of the park containing Old Faithful and other famous geysers.

On the north side of Old Faithful there are at least six or eight stumps in which the wood-fibers have been found to contain a large amount of silica. Evidently this silica is being deposited at intervals from the geyser water, according to the park naturalist, C. Max Bauer. The petrification of the stumps is a very slow process.

The Yellowstone already has an interesting display of fossil forests located over extensive areas in the northern part of the park. These, however, are the result of successive outbreaks of volcanic activity in the past. What happened in these cases apparently was that a standing forest was engulfed in great clouds of volcanic dust until the trees were completely buried. Water seeped through this dust and into the buried trees, carrying with it silica from the volcanic ash. The woody structure of the trees was dissolved and the silica deposited in its place. The trees thus became fossilized.

Long afterwards, when the volcanic activity had quieted and sufficient soil had accumulated on top of the buried trees, another forest grew, only to meet the same fate. This happened again and again.

To-day, at Specimen Ridge in the northeast portion of the park, trained observers can distinguish in some places a succession of these forests, twelve in number, one above the other.

JANUARY MORTALITY RECORDS

THE good health records for the United States and Canada maintained during the last few years will probably not be continued in 1933. Judging from the January death reports, the health outlook for the coming year is anything but promising, officials of the Metropolitan Life Insurance Company point out in their most recent report.

The January, 1933, death-rate of 10.8 per thousand is the highest recorded for the first month of any year since 1929 and with the exception of 1929, it is the highest for more than a decade.

Influenza and pneumonia were responsible for nearly one fifth of all the deaths during January, 1933. In addition, deaths from cancer, diabetes, cerebral hemorrhage, heart disease and suicide increased sharply over the deaths from these causes a year ago.

The death rate for diabetes reached a new high figure in January, 1933, which has never been even closely approached in any month of any preceding year. This is thought to be the result of the influenza epidemic. Diabetics who become victims of influenza are frequently without sufficient resistance to withstand both diseases, and their deaths occur during the influenza outbreaks instead of later.

A number of years have made excellent health records despite bad beginnings. The year 1929, which started with a bad influenza outbreak, is given as a conspicuous example. "Nevertheless health conditions from now on will need to be exceptionally good to counterbalance the January setback and to establish a record for the year at or near the remarkably low mortality figure for 1932."

MEDIEVAL CONSERVATION

CONSERVATION of natural resources in Germany is no new thing. It has its roots in the Middle Ages, a recent examination of old records has disclosed.

Long before pearls appeared in any numbers from distant India and Ceylon, ladies in Central European castles wore excellent fresh-water pearls that came from the tributaries of the Danube in the Bavarian and Bohemian mountains. In Passau, where the River Inn flows into the Danube, a long line of Bishops of the Church held sway also as temporal princes, their reigns lasting from 739 to 1803 in uninterrupted succession. These bishops gave thorough protection to the pearl-

producing river mussels and clams, and decreed severe punishment to poachers. This protection ended when the temporal rule of the bishops was broken and the secular authorities sought wealth in the timber of the mountains. The logging operations kept the streams so constantly roiled that not only were the pearl mussels vastly reduced in numbers but the salmon, beaver and otter were practically wiped out. Not until 1929 did this destruction cease.

The churchmen-princes protected other forms of native animal life besides the wealth-bringing pearl mussels. They protected meadows where wild swans, herons and storks bred, and maintained regular beaver preserves. They even sent their retainers out to fight when neighboring noblemen attempted to raid these game sanctuaries. Not even the Peasants' War of Reformation times, with its attendant hardships and anarchy, was able to wipe out the beaver. They held out until the wars of the eighteenth century, and a few were seen alive even into the nineteenth.

The pearl mussels have survived, though in much reduced numbers. At a recent fisheries exhibition held in Passau, native pearls were displayed which compared favorably with pearls in Ceylon.

ITEMS

A HEAVENLY object that may be a new comet or a minor planet has been found on the photographic plates of the Harvard College Observatory by Dr. F. L. Whipple. It is faint and visible only through large telescopes.

SPRING of 1933 will commence at 8: 43 P. M., Eastern Standard Time, on Monday, March 20, according to computations made at the Nautical Almanac Office, in the U. S. Naval Observatory. At that moment, the sun, which has been traveling northwards through the sky since last December, will cross the equator, and enter the zodiacal sign of Aries. This is called the vernal equinox and at this time of year the sun is below the horizon just as long as it is above, so that days and nights are of equal length. Also, on this date, the sun rises directly east and sets due west. Spring will continue until June 21, when the sun ceases its northward journey, and will start south again.

PUBLIC health need not suffer when budgets are reduced. Evidence of this is found in Chicago, the American Medical Association has pointed out. In this city during 1932 the infant death rate and the general death rate were reduced below the records of any other year, although the health department budget was reduced $500,000 in this one year. For a cosmopolitan as well as metropolitan center like Chicago, the American Medical Association considers this an achievement of the first magnitude.

YELLOWSTONE PARK beavers are not slaves of one material in their engineering efforts. Park Ranger F. Sheldon Dart has found a beaver dam built of stones on a small stream in the Thorofare district. The dam is approximately six feet long and varies from one to two feet in width. It is two and a half feet high at the highest point. Only a few willow twigs appear in its construction, almost all of its material being stone. The rocks range in size from pieces as large as a man's fist to some ten inches in diameter and twelve to fourteen inches in length.

GERMANY'S moose herds, relatives of the great antlered animals of the American and Canadian woods, are facing the danger that comes to them annually in the early spring flooding of the rivers that flow through the flat woods of East Prussia where they live. Burdened with ice, the streams sweep down the strongest swimmers among them. Another menace that the floods bring to the moose is that of starvation. The inundations force the moose to abandon their usual habitats and take to higher lands or to refuge islands which have been especially constructed for them. As long as the food supply holds out all is well, but the amount of browse available on these limited areas will not suffice the crowded herds long, especially if the waters rise high. Losses through starvation are especially large among the young animals, which can not reach the higher branches of the shrubs on which they feed. In a really bad flood year all the calves may starve.

THE nation-wide government inventory, or census, of Sweden's forest supply has now been completed after eight years of incessant work and at a total cost of about $280,000. The census was made by means of examining all trees within many parallel forest belts ten meters (30 feet) wide and drawn at certain fixed intervals. The combined length of the lines thus covered by the tree checkers is about 52,000 kilometers (31,200 miles) or more than one and a quarter times around the world, and the number of tree trunks marked and examined amount to more than 12,000,000. The result of the inventory as a whole was most gratifying, in so far as it showed not only the forest wealth of the country, but also indicated that the regrowth was considerably greater than what had generally been anticipated. Sweden's total forest area is about 58,000,000 acres. The present value of the wood is estimated to be about $240,000,000. The investigators found that the regrowth is improving considerably. Another fact is the high age of the trees. Thus in Lapland 32 per cent. of the trees were found to be over 160 years and 45 per cent. over 120 years old.

EVIDENCE that moving storm areas of low barometric pressure affect radio signals of wave-lengths longer than 100 meters by varying the strength of the lower ionized layer of the earth's atmosphere was presented by Professor R. C. Colwell and I. O. Myers, of the West Virginia University, speaking at the meeting of the American Physical Society. Two ionized layers that reflect radio waves are now known to exist. One of these, the lower, Kennelly-Heaviside or E layer, has been shown by Dr. E. V. Appleton, British physicist, and others, to reflect the long waves, while a higher, or F layer, sends back to earth the short waves. This indicates to Professor Colwell that the lower, or E layer, is in the region affected by varying pressure. He finds that the E layer is concentrated in the regions of low pressure and is most active in the eastern half of the storm cyclone or whirl of winds.

SCIENCE NEWS

Science Service, Washington, D. C.

POSITRONS

THE positron is formally introduced to the world of physics in a communication by its discoverer, Dr. Carl D. Anderson, of the California Institute of Technology, to *The Physical Review.*

August 2, 1932, is given as the date of the first photograph of the positive electron, christened positron for short, which has the mass of the older negative electron but a positive electric charge like the proton, which is nearly 2,000 times more massive.

A search for a negative particle of the mass of the proton was urged by Dr. Anderson, who predicted the possibility of its existence.

To date, Dr. Anderson has obtained 15 photographs of positron tracks in a group of 1,300 photographs of cosmic ray tracks. Positrons are let loose from atoms bombarded with cosmic rays. Dr. Anderson offers the following suggestion as to what happens:

"From the fact that positrons occur in groups associated with other tracks it is concluded that they must be secondary particles ejected from an atomic nucleus. If we retain the view that a nucleus consists of protons and neutrons (and alpha particles) and that a neutron represents a close combination of a proton and electron, then from the electromagnetic theory as to the origin of mass the simplest assumption would seem to be that an encounter between the incoming primary ray and a proton may take place in such a way as to expand the diameter of the proton to the same value as that possessed by the negatron. This process would release an energy of a billion electron-volts appearing as a secondary photon. As a second possibility the primary ray may disintegrate a neutron (or more than one) in the nucleus by the ejection either of a negatron or a positron with the result that a positive or a negative proton, as the case may be, remains in the nucleus in place of the neutron, the event occurring in this instance without the emission of a photon. This alternative, however, postulates the existence in the nucleus of a proton of negative charge, no evidence for which exists. The greater symmetry, however, between the positive and negative charges revealed by the discovery of the positron should prove a stimulus to search for evidence of the existence of negative protons. If the neutron should prove to be a fundamental particle of a new kind rather than a proton and negatron in close combination, the above hypotheses will have to be abandoned, for the proton will then in all probability be represented as a complex particle consisting of a neutron and positron."

BERYLLIUM ATOMS PROVED RADIOACTIVE

A NEW and striking case of radioactivity, the spontaneous explosion of beryllium atoms, is the discovery announced at the California Institute of Technology by Dr. R. M. Langer and his associate, Russell Raitt, a graduate student.

This is probably the first successful prediction of radioactivity and it promises to lead to many others. Dr. Langer and Mr. Raitt first predicted the radioactive disintegration of the metallic atoms of beryllium and then systematically searched for the expected effect until they found it.

The effect of the explosion is so weak that the physicists know that the average beryllium atom will live a hundred trillion years (100,000,000,000,000 or 10 to the fourteenth power) before exploding. Extended researches show that none of the known radioactive elements can be responsible for the effects that the experimenters attribute to the beryllium atoms.

Beryllium is almost as unlike the ordinary radioactive elements as it is possible to be. It has a mass only nine times that of hydrogen whereas the most active radioactive elements have masses ten or more times larger.

Data gathered from studying the spontaneous explosions of beryllium atoms into fragments are expected to provide powerful tools in unraveling the mysteries of the atomic nucleus.

The radioctivity of beryllium accounts for the puzzling fact that beryl minerals often contain much more helium than could be explained on other hypotheses. Helium is set free when beryllium explodes.

Of great interest to physicists also is the prediction by Dr. Langer and Mr. Raitt that a new form of helium atom will be found in the future. This has a mass of five instead of the usual mass of four, and it is predicted that this heavy helium will explode spontaneously and thus prove to be the lightest radioactive element.

MOSQUITO MAY CARRY HORSE PLAGUE

A SERIOUS epidemic disease of horses and mules, popularly known as Kansas-Nebraska horse plague, may be spread by the yellow fever mosquito, *Aedes aegypti.*

Whether the mosquito actually is the villain that spread an epidemic of the disease which affected 6,000 and killed 3,000 head of horses and mules in one season in California has not yet been proved. So far neither the mosquito nor any other insect has been caught in the act of spreading the disease from horse to horse.

But strong evidence of the mosquito's possible guilt has been obtained at the Army Medical School. Major R. A. Kelser, of the Veterinary Laboratory Division, has reported the fact that the yellow fever mosquitoes can spread the disease among guinea-pigs.

Mosquitoes infected with the causative virus of the disease have so far failed to give it to a horse. This may be explained by the fact that the horse on which the infected mosquitoes were allowed to feed is an old army horse and may have been exposed to the disease and consequently developed resistance to it earlier in its career. Major Kelser plans to feed the infected mosquitoes on a young horse whose history of infection and exposure to disease is known. He is also planning investigations with monkeys as to the rôle of mosquitoes in this disease.

Known to scientists as equine encephalomyelitis, this horse plague has been known under various names in both America and Europe for half a century or more. In Europe its most common name is Borna disease, taken from a region where a disastrous epidemic raged, just as the popular name in this country, Kansas-Nebraska horse plague, comes from the wide-spread outbreak in those two states some years ago.

The disease has been confused with many other diseases, among them forage poisoning, but in 1930, 1931 and 1932, Professor K. F. Meyer, of the Hooper Foundation, and associates of the University of California and California Agricultural Experiment Station definitely proved that the disease is caused by a germ of the filtrable virus type. The virus attacks the brain and spinal cord of the animals. Two types of the disease are said to occur: the sleepy type in which the animals may drowse until disturbed, when they may have convulsions, and the walking type in which the animals pace around and around the field.

The disease attacks only horses and mules under farm conditions and is not apparently a serious menace to humans, although two cases in California were reported in which men apparently acquired the disease from handling infected animals.

In a discussion of Major Kelser's report, investigators of the U. S. Department of Agriculture brought out the fact that while yellow fever mosquitoes were not found in California, Kansas or Nebraska, where the chief epidemics of this disease have occurred, many other kinds of mosquitoes and biting insects were found. It is possible that some of these other species may have spread the disease in those localities. Studies at the Bureau of Animal Industry seemed to show that contact between healthy and infected horses is not an important factor in the spread of the disease. This supports the theory of insect transmission.

CHEMICAL ANTIDOTES FOR BACTERIAL POISONS

WE may not have to depend forever on painfully, often uncertainly elaborated antitoxins, serums and vaccines for the combating of our bacterial foes. Eventually antidotes for germ poisons may come off the chemist's shelf instead of out of a horse's veins. But before that day, as yet far off, a great deal of fundamental research will have to be done, involving cooperation by scientists in a number of fields.

Thus Dr. Stanhope Bayne-Jones informed the Yale chapter of the Sigma Xi in a recent lecture. Dr. Bayne-Jones is professor of bacteriology at Yale University and chairman of the medical division of the National Research Council at Washington, D. C.

But before we can undertake to make synthetic antidotes for bacterial poisons we must find out what these poisons are, and that is no easy task, Dr. Bayne-Jones reminded his hearers. They are exceedingly complex in their chemical make-up, and at the same time exceedingly easy to break down, so that efforts at study often end in destroying them without finding anything about them.

However, enough has been found out about some of them to constitute at least a fair chemical "lead," and something may be accomplished without waiting for the complete solution of these chemical and pharmacological problems.

Dr. Bayne-Jones stated that "it is probable from the ability of formaldehyde to deprive bacterial poisons of toxicity that the amino nitrogen group in the molecule has a good deal to do with the poisonous effect and that this group may be vulnerable to a chemical antidote. Oxidases destroy toxins and have some protective value. Acids remove toxicity, possibly according to the benzoyl serin intramolecular rearrangements described by Bergmann. Copper and iron appear to be essential to the production of some bacterial toxins. There are evidently enough 'chemical leads' to justify a more extended investigation of the possibilities of chemical antidotes for these poisons.

"Although the search for chemical methods of neutralizing bacterial poisons in the body might have a frankly practical objective, the end could not be reached satisfactorily without extensive bacteriological, immunological, biochemical and clinical research. The problem, like that of the chemistry of tuberculosis, needs for its solution the joint endeavors of investigators in several fields."

MORE EARTHQUAKES EXPECTED IN SOUTHERN CALIFORNIA

THE Long Beach, California, earthquake, the aftershocks of which will be felt for months, was nevertheless not a general one and probably did not relieve the strain in the earth's crust in other parts of Southern California.

This is the opinion of Professor Bailey Willis, the eminent authority on geology and seismology who is professor emeritus at Stanford University.

There is, therefore, continued danger of severe earthquakes in southern California. When these will come, whether to-morrow or a decade or more from now, neither Professor Willis nor other geologists can attempt to predict.

"The Long Beach earthquake appears to be a shock of moderate intensity on one of the several faults of the San Pedro fault zone," Professor Willis said in response to a Science Service inquiry. "This fault zone was recognized by H. O. Wood, who described it in the *Bulletin* of the Seismological Society, 1916, in his account of the 1812 quake.

"Among the effects of movements on that zone we may recognize the elevation of the San Pedro point which is terraced by marine benches up to more than 1,000 feet above sea and demonstrates activities extending back more than a million years. The zone has the earthquake habit and may be expected to behave accordingly from time to time as in the past. Aftershocks are likely to continue for several months and some of them may be strong. Measures of safety should be rigidly enforced. Although locally disastrous, this Long Beach shock is not a general one and probably does not relieve the strain in the San Jacinto or San Andreas faults. The disaster

emphasizes the need of earthquake-resistant buildings under a reasonable building code recognizing earthquake hazards.''

The San Andreas fault is the long cleavage in the earth's crust which runs from north of San Francisco along the coast to northwest of the Los Angeles region inland. Along this fault the great 1906 San Francisco earthquake occurred. The San Jacinto fault is to a certain extent an extension of the San Andreas fault southward of it.

INCREASE IN NUMBERS OF THE PRONGHORN ANTELOPE

THE pronghorn, slender and beautiful antelope-like animal of the American West, is believed to be on the increase. Thought to be even nearer extinction than the American buffalo or bison was a generation ago, they are shown by a census conducted by the New York Zoological Society to be approximately 68,000 in number in the United States, with 2,400 additional in Canada. A similar census by the U. S. Biological Survey ten years ago indicated less than 27,000 in this country and 1,327 in Canada. Figures for the present zoological society census were supplied by federal, state and dominion authorities.

Wyoming leads the list, with 25,000 animals, as estimated by that state's fish and game commission. An unofficial estimate disagrees with this, setting the number considerably lower. Other states show pronghorn populations ranging from as high as 9,000 in Oregon down to a mere baker's dozen in Nebraska.

When white men first came to the plains, pronghorn were even more numerous than the bison, but the spread of agriculture and grazing, and the relentless guns of the hunters reduced them to an even lower estate than that of their shaggy-maned companions. Only by rigid protection in most states, together with an extensive propaganda campaign urging hunters to spare the beautiful little animals, have they been given a chance to begin their hopeful comeback.

There is a small herd of a few hundred pronghorn in Yellowstone National Park, on the buffalo range in the Lamar Valley. It is here that the average citizen perhaps has the easiest chance to see them, for the Yellowstone pronghorn are even less timid than their brethren elsewhere. Confident in their remarkable running speed, they will race automobiles, being able to keep up a speed of 35 miles an hour for considerable distances.

Zoologically the pronghorn is not related to the true antelopes of the Old World, and it has no other near relatives. It is remarkable among horned creatures in that it is the only hollow-horned animal that sheds its horns every year. Deer shed their antlers, but these are solid. Cattle and sheep have hollow horns, but never shed them. It is because of this unique scientific position as well as because of its rarity that zoologists have been anxious to see the pronghorn saved.

ITEMS

DOUBLE weight hydrogen, the newly discovered mass two isotope of this lightest of the elements, will be ''so different from common hydrogen that it will be regarded almost as a new element,'' Professor Gilbert N. Lewis, of the University of California, expressed as his belief in a communication to the *Journal* of the American Chemical Society. He recently obtained the heaviest water on record as a result of separating electrolytically hydrogen gas consisting largely of the heavier kind of hydrogen. If the heavy hydrogen proves to be as different as he expects, Professor Lewis predicts that the organic chemistry of compounds containing the heavy isotope of hydrogen will be a fascinating study.

MOTION-PICTURES of life at its lowest possible denomination were shown at the Atlantic City meeting by Dr. Frank L. Howard. Dr. Howard exhibited two films showing the activities of myxomycetes, or slime molds, which are creatures so far down the evolutionary ladder that it has never been decided definitely whether they are plants or animals. They have some of the characteristics of either. The films showed the streaming, creeping motion of the masses of naked protoplasm of which the slime molds' bodies are composed during certain stages of their lives. They showed their ripening into the reproductive stage, the production of the spores and the ingenious mechanisms by which these reproductive bodies are scattered to the wind to drift away and germinate in a new place.

SYNTHETIC vitamins manufactured by organic chemists from cheap and plentiful raw materials were predicted by Dr. George Oliver Curme, Jr., in the annual Chandler lecture which he delivered upon the occasion of his receiving the 1933 Chandler Medal for research in chemistry. Dr. Curme directs the research of the Carbide and Carbon Chemicals Corporation. Vitamins A, B and C have been found to be closely related to substances of complex molecular structure, so that synthesis ''seems entirely possible,'' he explained. In the case of other vitamins less is known, although it would be surprising from the information now available if they were beyond the range of synthetic chemistry. He predicted that adequate supplies of vitamins will soon be available from relatively cheap and abundant sources and that under the guidance of physiological chemists and dietary experts synthetic chemistry will be able to add another triumph to its many past successes.

PROPAGANDA now being spread among school officials contending that individual experimentations by students of chemistry can be replaced by lecture demonstrations, slides or motion pictures, was deplored in a statement by Professor Ross A. Baker, in charge of the College of the City of New York's department of chemistry, issued as a preliminary to the Washington meeting of the American Chemical Society. Many school boards are likely to accept inconclusive data and scrap school chemical laboratories to save expense. Sales of chemical toy sets by hundreds of thousands is evidence of the desire on the part of boys and girls to experiment. He urged organized education to answer this need or the formation of chemistry clubs with the aid of chemistry teachers.

SCIENCE NEWS

Science Service, Washington, D. C.

PAPERS PRESENTED BEFORE THE WASHINGTON MEETING OF THE AMERICAN CHEMICAL SOCIETY

STRAWBERRIES, it seems, besides being a most tasty fruit, are excellent sources of scurvy-preventing vitamin C. Two grams of them, which is about one fourteenth of an ounce and not very much in terms of big, fat berries, fed daily to guinea-pigs protected the animals from scurvy and enabled them to make good weight gains. The berries do not lose their vitamin C content on freezing, so you may purchase the commercial frozen variety, if you prefer, and you may eat them in ice cream and still be getting this important vitamin. The good news was brought to the meeting by Professor Carl R. Fellers and Merrill J. Mack, of the Massachusetts Agricultural College.

COTTONSEED meal, valuable cattle feed by-product of the cotton industry, is a rich source of vitamins B and G, according to Professor May L. Whitsitt, of the Southern Methodist University. She found cottonseed meal richer in these two important factors than an equal weight of whole wheat, dried yeast or skim milk powder. Cottonseed oil shows no trace of either of these two vitamins, while the hull bran has a varying amount of the vitamins depending on the way it is extracted. Vitamin B is necessary to prevent the development of beriberi in man or a condition known as polyneuritis in birds. Vitamin G, also known as vitamin B_2, is said to be the factor in certain foods, notably yeast, that prevents pellagra in man and a similar condition, black-tongue, in dogs.

How much vitamin A there is in milk, and in the butter made from cream, depends to a considerable extent on the kind of hay the cow gets, as reported by Dr. E. B. Meigs, A. M. Hartman and H. T. Converse, of the U. S. Bureau of Dairy Industry. Dr. Meigs and his associates found that milk and butter produced on a basis of good alfalfa hay to be definitely richer in this essential vitamin than similar products based on a poor grade of timothy hay. High-grade alfalfa fed to dairy cows is reflected later in a rich natural yellow in their butter, indicative of a high vitamin A content.

VITAMIN B_1, preventive of the Oriental disease beriberi and other nerve disorders, has been obtained in crystals by Dr. Atherton Seidell and Dr. M. I. Smith, of the U. S. National Institute of Health. This achievement is considered important because it makes the vitamin available in pure form for chemical study. Dr. Seidell and Dr. Smith obtained a concentrate of vitamin B_1 from brewers' yeast by processes already known. This they treated with picrolonic acid, precipitating out substances of no vitamin value. The liquid left over, when evaporated, yielded a partially crystalline deposit, which after further purification gave them a quantity of prismatic crystals. These crystals appear to be the vitamin in pure form. Rats suffering from a deficiency of vitamin B_1 were cured with as little as fifteen thousandths of a milligram—about as much as you could pick up on the point of a pin.

FARMERS of the far future may keep pans of Penicillium instead of pens of pigs. For experimenters of the U. S. Bureau of Chemistry and Soils have found a species of mold, known botanically as *Penicillium javanicum*, that beats the hogs at the job of turning carbohydrates into fat. At the meeting of the American Chemical Society, G. E. Ward and L. B. Lockwood told of their researches on this and other fat-making molds. They found several species of Penicillium that contained a good deal of fat when well fed on glucose, but the one called javanicum was the champion of the lot. Its matted mass of white threads, when dried, contained from 20 to 43 per cent. of fat, depending on culture conditions. It takes only twelve days for the mold to produce the maximum quantity of fat out of the glucose solution. When they extracted the fatty material it came out as a reddish-orange oil, with a nut-like odor. A preliminary chemical examination showed it to be built up of the same constituents as many of the fats and oils that are now familiar articles of commerce. The new "mold-oil" is still in the experimental stage, and no definite commercial use for it has been suggested, but there is no doubt that industrial uses may some day be found for it if large-scale production makes it cheap enough.

DILUTE solutions of hydrochloric acid, alkalis and mixtures of hydrochloric acid and kerosene, are being used successfully in removing poisonous sprays from fruits before they are marketed. These measures have not solved all the problems of making fruit safe for consumption while at the same time protecting it from insect pests, but gratifying progress is made each year, according to Professor R. H. Robinson, of the Oregon Agricultural College. Professor Robinson addressed a special symposium of the society on insecticides. "The most important insect enemy of apples and pears, the codling-moth, can be held in check only by lead arsenate," he explained. Previous experience has shown that the maximum amount of arsenic that can be safely left on food is one hundredth of a grain of arsenic per pound of food, W. B. White, of the U. S. Food and Drug Administration, stated. Lead is also used in insect sprays of fruits and vegetables. Mr. White reported that as little as one tenth of a milligram of lead per day will produce serious symptoms if taken over a period of seven or eight years. Fluorine, another substance used in insect sprays, produced a condition known as mottled enamel in the teeth of children when the fluorine was present in drinking water to the amount of two to three parts per million.

E. F. KOHMAN and N. H. Sanborn, of the National Canners' Association, reported that the prune may find

new favor, together with fresh flavor, when it appears on the breakfast table fresh from the can. Lemon juice or possibly other fruit juices, being added to canned prunes in order to prevent corrosion of the can, improve the flavor. It is the citric acid of the fruit juices that prevents corrosion. The French or Santa Clara variety of prune must be dried in the first place in order to produce the most desirable flavor. But preparing a dried product for a meal is more of a chore than the modern housewife may care to undertake, so the industry is trying to simplify this culinary task by canning the prunes. Drying, however, increases the tendency of the prunes canned in syrup to attack the can. Citric acid, or lemon juice, takes care of this.

CALCIUM, claimed by some investigators to have a checking effect on cancer, failed in this respect in a large number of experiments on mice performed by Dr. M. J. Shear, of the U. S. Public Health Service. He transplanted cultured cancers of two types on to the bodies of some 1,200 mice, and administered three different chemical salts of calcium either in the drinking water, in the food or by injection into the body. But the results were all negative. Treatment produced no reduction in the number of takes. Slightly smaller tumors were sometimes obtained in the treated mice, but a definite, regular reduction in the size or in the rate of growth of the tumors was not obtained.

THE amount of pepsin in the stomach juice of patients suffering from stomach ulcer may give physicians a good index as to the progress and outcome of the disease. Drs. Arnold E. Osterberg and Francis R. Vanzant, of the Mayo Clinic, studied the pepsin concentration in the stomach juice of some 400 patients after an Ewald type of test meal. They found a correlation between the pepsin concentration and the severity of symptoms which indicated that the pepsin concentration is a valuable prognostic sign.

PROGRESS in the search for pain-relieving, sleep-producing drugs that are without habit-forming properties and may therefore be substituted for the dangerous morphine was reported by Dr. Lyndon F. Small, of the University of Virginia, and Dr. Nathan B. Eddy, of the University of Michigan. The researches described by Drs. Small and Eddy are being carried out under the direction of a special committee of the National Research Council. One phase of the research has consisted in changing the arrangement of the morphine molecule and then observing the pharmacological effects of the altered drug. Certain changes in the chemistry of morphine always produce certain changes in its effect.

THE thyroid gland, important in the regulation of bodily functions, varies in size according to age, and also fluctuates in size according to the season of the year. These observations were reported by Harry von Kolnitz and Dr. Roe E. Remington, of the South Carolina Food Research Commission. Messrs. von Kolnitz and Remington examined the thyroids of 150 human bodies in Charleston. They found that up to the age of forty, human thyroids increased in size; after that they declined steadily. Women's thyroids averaged larger than men's, but contained a lower percentage of iodine. Thyroids varied seasonally, increasing in weight from April to a peak in July and then decreasing to a constant level from October on through the winter. This latter result disagrees with findings of earlier investigators.

HOW the hemoglobin-producing factors of human liver are affected by various diseases was reported by Dr. G. H. Whipple, of the University of Rochester School of Medicine. Dr. Whipple was one of the pioneers whose investigations led to the liver treatment for pernicious anemia, in which disease the hemoglobin content of the blood is somewhat reduced. Acute infections reduce the store of these potent hemoglobin-producing factors in the human liver somewhat. On the other hand, chronic intoxication had very little effect. In cirrhosis or inflammation of the liver there was a marked reduction in the amount of the hemoglobin-producing factors. Pernicious anemia showed very high values for these factors. Secondary anemia due to loss of blood showed low normal values, but even long standing severe anemia will not seriously deplete this store of hemoglobin-producing factors in the liver. In anemia due to loss of blood there may be complete dissociation between the iron content and the concentration of hemoglobin-producing factors.

MOLDS are usually thought of as fungous growths that spoil things; but they can be chosen to turn their "spoiling" activities in useful directions. Research scientists of the U. S. Bureau of Chemistry and Soils described recent progress in the taming of the aspergilli and the penicillia. Two tasks at which molds have proved themselves efficient workers have been the production from glucose solutions of citric and gluconic acids. The former is the familiar acid of lemons; the latter is a rarer acid, of possible use in medicine and industry, which, thanks to the work of the government investigators, now costs dimes a pound where it used to cost dollars.

COLORED fabrics that fade on exposure to light are not fading in the same way that they do when their colors are "washed out" in the laundry. The latter process is merely a reversal of dyeing—the dyestuff merely becomes "unstuck" and diffuses out into the water. Sun-faded fabrics have their dyestuffs actually changed over into other substances, which may have colors of their own. This accounts for the fact that a sun-faded fabric may not merely be paler than it was when new, but may have a quite different hue. These facts about sun-fading were brought out by William D. Appel, of the U. S. Bureau of Standards, and William C. Smith, of the Lowell Textile Institute.

SYNTHETIC stone, made from plentiful shale deposits

or waste limestone, marble, granite and slate quarries, will rival present building materials and compete for the job of entering into the construction of skyscrapers and homes of the future. This was predicted by Professor R. Norris Shreve, of Purdue University, in presenting details of rostone developed in Purdue laboratories by R. L. Harrison and Professor H. C. Peffer. Pulverized limestone and shale, after being properly mixed and moistened to earth dampness, is pressed in a polished steel mold, under a pressure of 2,500 pounds per square inch. The mold is then permitted to dry for a time, later going into an "indurator" which is heated by steam. There the chemical reaction takes place, working as a binder in bonding the particles of limestone together. The pressed block or slab of limestone and "matrix" is then ready for immediate use or it may be polished the same as granite, or marble. The entire process of grinding, mixing, pressing, "steaming" and finishing takes barely a half day, thus giving in a few hours this man-made stone, which nature requires decades or centuries to produce.

GAS stoves and other gas-burning appliances that are safe and suitable for use in low altitudes need to have their "settings" for gas and air flow set differently for safety in high-altitude cities like Denver. J. H. Eisemann, Dr. F. A. Smith and C. J. Merritt, of the U. S. Bureau of Standards, reported on their experiments on the changes needed in gas appliances for safe operation at high altitudes. In general, they found that the maximum safe rate for the supply of gas at sea-level, measured in heat units consumed per hour, is reduced by approximately three to four per cent. for each thousand feet of altitude; but the number of cubic feet per hour of gas of given composition which can be burned completely is practically independent of altitude. The area of flue opening which will permit the flow of enough air to insure complete combustion increases somewhat more rapidly than in proportion to the altitude at each gas rate, and this effect is the greater the higher the gas rate.

WHEN a man falls victim to a fire, if he is not burned outright he is frequently said to be "suffocated by the smoke." But in many cases he is killed by something much more deadly than smoke. Many common household things give off some of the most toxic of poisonous gases, Professor John C. Olsen, of Brooklyn Polytechnic Institute, reported. Professor Olsen has as collaborators in his investigations George E. Ferguson and Leopold Scheflan. The gases from all types of fires investigated contain toxic constituents in sufficient amount to make breathing the gases dangerous or even fatal in a relatively short period. They vary greatly in toxicity. Those most toxic come from substances containing nitrogen or sulphur or both of these elements. Textiles such as clothing, draperies, etc., cotton and rayon produce the least toxic gases, while silk and especially woolens give off hydrogen sulphide, hydrocyanic acid, sulphur dioxide and ammonia, as well as carbon monoxide.

MOTION-PICTURES showing how ultra-violet light of certain wave-lengths kills cells were shown by Dr. Ellice McDonald, Alexander J. Allen and Rachel Franklin, of the University of Pennsylvania. They used cells from the spleen for their experimental material, and the wave-lengths turned on them ranged between 4,350 and 2,253 Ångström units. The wave-lengths that were fatal to the cells killed in from fifteen to twenty seconds. The living protoplasm of the cells became greatly agitated, bubbles appeared on the membrane and as a rule the cells finally burst. The killing effect of the shorter ultra-violet light can not be equaled by fifteen hours of exposure to strong radiation from radium, nor is the lethal effect of ultra-violet light equaled by twelve to twenty-four hours of exposure to high-voltage x-rays.

CHEMISTRY, which has contributed so essentially to America's economic progress, is in this depression helping to camouflage inferior quality merchandise. This danger was pointed out by H. L. Derby, president of the American Cyanamid and Chemical Corporation. "One of the notable incidents of the present depression is the demand for low-priced merchandise, quality being one of the lesser considerations—quite the reverse of the prosperity type of demand," said Mr. Derby. "In past generations the distinctions between good and cheap merchandise were readily discernible by the most inexperienced observer. However, modern chemistry has largely eliminated the superficial differences by neatly and attractively covering up the inferior quality." Chemistry's large contribution to America's industry and independence from foreign sources of essential materials were cited by Mr. Derby, who also predicted the future course of this science applied to industry.

NOT all the ancients who labored mysteriously with beakers and alembics were mere alchemists, either muddle-headed themselves or deliberately out to fool their neighbors. There were real chemists among them, who knew that the "gold" they were making out of base metals was not real gold. So Professor Tenney L. Davis, of the Massachusetts Institute of Technology, reported. The chemists of ancient Alexandria knew the difference, he said, and so did the medieval genius Albertus Magnus, the earliest scientist to be canonized as a saint. Albertus, said Professor Davis, wrote in his "De Alchimia" that the gold of alchemy is identical with real gold "in every test and hammering"; but he also wrote in another part of the same book that "the gold of alchemy does not gladden the heart of man, nor cure leprosy, and wounds fester which are made by it." This indicates that Albertus knew that "the gold of alchemy" was brass. Apparently independently of the West, the Chinese invented a system of alchemy about the third century B. C. The Chinese alchemists hoped to produce actual immortality by chemical means, and to become "hsien" or supernaturally endowed, benevolent immortals. Professor Davis also set forth the reasons for believing that Arabic alchemy was derived from that of the Chinese.

SCIENCE NEWS

Science Service, Washington, D. C.

CANCER FOLLOWING GERM INJECTION

DEVELOPMENT of cancer following the injection of a germ or micro-organism is announced by the U. S. Public Health Service's National Institute of Health. The discovery was made by Drs. T. J. Glover and J. L. Engle, who have been working at the institute, although they are not attached to the regular government staff nor to the U. S. Public Health Service. They have succeeded in producing typical, unmistakable cancer in a guinea-pig. This cancer followed the injection of a culture of a micro-organism or germ isolated from the tissues of a proved case of cancer of the human breast. This traverses the prevalent opinion that cancer is not a germ disease. It is only after years of work that the announcement has been made.

Application of the new discovery to the treatment of human cancer is far in the future, but the experiments of Drs. Glover and Engle promise to blaze a new line of cancer research that appears very hopeful. "It promises to open a valuable field for further research," commented Dr. George W. McCoy, director of the institute.

Drs. Glover and Engle have found that cancer in rats follows injection of their culture of germs from human cancerous tissue. But rats develop cancer so very easily that this was not considered convincing evidence that the germ culture actually could cause cancer. The production of cancer in guinea-pigs, which, so far as any one knows or can find out, do not readily develop it, is considered much more of a feat and more convincing that the germ culture of Drs. Glover and Engle is cancer-producing.

The cancer produced in the guinea-pig has all the characteristic appearance of cancer when examined by the unaided eye and under the microscope. Furthermore it spread, producing cancer in other parts of the body, thus fulfilling another of the criteria for the diagnosis of the growth as cancer. The germ itself is what scientists call a spore-bearer. It was isolated on special media from the tissues of the human cancer.

In the report only one case of cancer in the guinea-pig is described. The diagnosis of cancer in this case was confirmed by a pathologist of the National Institute of Health, and the foremost staff bacteriologist is now checking the bacteriological side of the work.

Dr. Glover started his investigations several years ago in New York. For the last three years, the work has been carried on by him and by Dr. Engle at the National Institute of Health where the director and staff scientists could follow and check various steps of the research.

In their report they do not claim specifically to have discovered the cause of cancer, but state with characteristic scientific reserve: "It is the purpose of this report to place on record the production of metastatic malignancy in one of a group of guinea-pigs inoculated with a culture containing a spore-bearing micro-organism which was isolated on special media from the tissue of a microscopically proven carcinoma of the human breast."

Further points to be determined are whether the micro-organism they have described causes the cancer, or whether it is caused by some virus or other germ present in the culture or by some toxin or other substance produced by the bacteria of the culture. It is possible that this culture is not the cause of all types of cancer, but of one group of them. Efforts to develop a serum, either curative or protective, will be a logical outcome of this research. Investigation of the infectiousness of a type of cancer produced by bacteria as this one was in the guinea-pig will also have to be developed.

One of the two physicians making the discovery is from New York, while the second is from Philadelphia. They had worked under private research grants for about ten years before bringing their experiments to the National Institute of Health for critical testing.

COSMIC RAYS

COSMIC rays are streams of particles or corpuscles, not electro-magnetic waves like light, x-rays or radium's gamma rays, Professor Bruno Rossi, leading Italian physicist, has concluded from experiments at the University of Padova's Institute of Physics. He finds that cosmic radiation observed at sea-level is exclusively a corpuscular radiation. From his experiments he also concludes that the primary cosmic radiation which reaches us from outer space is, in all probability, also a corpuscular radiation. In this conclusion Professor Rossi agrees closely with Dr. Arthur H. Compton and other experimenters in America who have found evidence that cosmic rays are particles, perhaps electrons.

Professor Rossi is now organizing a cosmic radiation expedition to Africa. Experiments will be made in the neighborhood of the magnetic equator with the purpose of testing his theories of how the magnetic field of the earth affects the cosmic corpuscles. On this expedition he will make tests similar to those that were a part of the world-wide surveys under the direction of Dr. Arthur H. Compton, of the University of Chicago.

"I have approached the problem of the nature of the primary cosmic radiation from the theoretical as well as from the experimental point of view," Professor Rossi said in an exclusive statement to Science Service. He is investigating the theoretical as well as the experimental evidence of the influence of the earth's magnetic field upon cosmic rays if they are corpuscles. He has already solved this problem theoretically in its general outlines.

"Since 1930 I have been devoting myself to an accurate study of certain corpuscles of very high energy, the ultra-penetrating corpuscles, which Drs. Bothe and Kolhörster, the German physicists, demonstrated as present in the atmosphere," Professor Rossi said. "The scope of this research is to study the properties of such corpuscles and their effect upon matter as well as to determine their relation to cosmic radiation—to determine whether they are generated in the atmosphere by a primary cosmic radiation of the type of gamma rays

or whether they consist of the primary cosmic radiation itself.

"To this end I have carried out an accurate and extensive comparison of the absorption of complex cosmic radiation with the absorption of corpuscular radiation, following the trajectory of the corpuscles through layers of lead up to a thickness of one meter by means of a recording device which notes each corpuscle as it enters and leaves the absorbing medium. I have not found any difference between the two absorptions.

"So far as concerns the effects produced by the corpuscles of the radiation when they penetrate matter, I have been able to demonstrate by means of a system of coincidental impulses of three recording instruments that the trajectories of these corpuscles fork at certain distances. This indicates that the divisions originate in the material traversed by secondary corpuscles. I have studied the properties of the secondary corpuscles in relation to the means by which they are generated and I have shown that to them are due all those anomalies in the absorption curve which have previously been designated as the 'transition effects.'"

ENERGY TURNED INTO MASS FOR FIRST TIME IN HISTORY

FOR the first time, physicists seem to have discovered a case of energy turning into mass, that is, non-material "push and shove" being converted into something material that can be weighed, as it were. Dr. Kenneth T. Bainbridge, fellow of the Franklin Institute's Bartol Research Foundation and authority on the masses of atoms, has concluded that when lithium is bombarded with the heart of a helium atom, energy may be converted into mass.

The experiments were first made by Mme. Irene Curie-Joliot, daughter of the discoverers of radium, and her husband, Dr. F. Joliot, at the Institut de Radium in Paris last year. Dr. Bainbridge examined the experiments in detail and finds that when a lithium atom of mass seven is hit by and captures an alpha particle, or helium atom heart, there is strong indication of the transfer of kinetic energy of the impinging alpha particle into what the physicists call "inertial mass." This creates an atom of boron of mass ten. This isotope of boron is found as one of the experimental products of lithium's disintegration.

"Change of energy into inertial mass must be viewed with caution," Dr. Bainbridge said in a Franklin Institute lecture, "but available experimental data make the suggestion the most plausible of four possible explanations."

While this is the first apparent case of energy being converted into mass, many cases of the changing of mass into energy are known. The transforming of mass of atoms into heat and light is a favorite mechanism for explaining how the sun and stars keep shining for billions upon billions of years.

The scientific value of disintegration and other nuclear experiments far surpasses the highly speculative economic values of release of energy from the atom, in Dr. Bainbridge's opinion. Following in the footsteps of Dr. F. W. Aston, the British physicist, who developed the mass-spectrograph to separate chemically identical isotopes and deal with them individually, Dr. Bainbridge has carried on mass-spectrograph studies at the Bartol Research Foundation.

"The spectrograph permits the investigator to determine what nuclear types exist," Dr. Bainbridge explained. "It is possible to determine the relative abundance of the isotopes of specific elements and so indirectly the chemical atomic weights and finally to make measurements of the masses of atoms to an accuracy of one part in 30,000. These measurements are important in connection with studies of the disintegration of atomic nuclei.

"The results of atomic mass measurements in cooperation with disintegration experiments furnish an experimental proof of the equivalence of mass and energy deduced theoretically by Einstein. The best example of this is given by the experiments of Cockcroft and Walton on the disintegration of the lithium seven nucleus by the capture of an incident proton resulting in the release of two helium nuclei with a combined energy of about 17,000,000 electron volts, which energy must be the result of a transformation of mass into energy."

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REITERATION that cosmic rays are probably electrons or other electric particles coming to earth from outer space and being deflected by the earth's magnetic field in such a way that the intensity is greater for high latitudes than near the equator is contained in a detailed report by Dr. Arthur H. Compton, of the University of Chicago, which appears in the *Physical Review*. Summarizing the researches of more than sixty physicists in a geographical study of cosmic rays throughout the world, Dr. Compton finds that at sea level the cosmic ray intensity at high latitudes is 14 per cent. greater than at the equator, at 2,000 meters (a little over a mile) it is 22 per cent. greater, and at 4,360 meters (over two miles high) it is 33 per cent. greater. Dr. Compton writes: "Consideration of the conditions necessary for deflection of high-speed electrified particles by the earth's magnetic field indicates that if the cosmic rays are electrons, they must originate not less than several hundred kilometers above the earth." He finds that his data can be quantitatively explained on the basis of the Lemaitre-Vallarta theory of electrons approaching the earth from remote space.

TESTING the hearing of chimpanzees was the rather novel task of a psychologist described by J. H. Elder, of Yale University, to the recent meeting of the New York Branch of the American Psychological Association. Chimpanzees are no harder to test accurately than are human children, Mr. Elder reported. His method was to train the apes to press a key when the signal was given and not to press it when they heard nothing. Standard earphones were used and the apes were then allowed to listen to sounds of known frequency from an audiometer. The frequencies heard by the chimpanzees are within the range audible to human beings, although several of the apes could hear frequencies lower than those heard by the average human being.

SCIENCE NEWS

Science Service, Washington, D. C.

THE MOST PROFITABLE INVESTMENT OF THE FEDERAL GOVERNMENT

BY WATSON DAVIS

Managing Editor, Science Service

SCIENTIFIC research conducted by the Federal Government is its most profitable investment. Among the millions and the billions for wars, past, present and future, for post offices, for Congress, for prohibition enforcement, for Indians, for interest on the public debt, for RFC and other dollar transfusions to the financial structure, for relief, for reforestation, there are items of a few thousands and hundreds of thousands of dollars for scientific research.

The U. S. Department of Agriculture scientists are finding new uses for familiar farm products, fighting soil erosion, improving livestock, protecting plants and crops, and safeguarding the ordinary consumer against bad food and drugs. In far off China or the tropics, explorers of the department roam to bring back strange plants that help our farmers. Within our country's borders, entomologists are combating the insect menace.

U. S. Geological Survey geologists are mapping and surveying the mineral domain that the machine age may not die of starvation. U. S. Coast and Survey ships and engineers are surveying our coasts to safeguard commerce and shipping.

Out in that group of Washington laboratories, not near the oratory of Congress, there are men and women of the U. S. Bureau of Standards staff studying the rainbow of chemical elements, developing new facts about heat, stressing steel and newer metals, perfecting standards, methods and processes of incalculable value to industry and pursuing a thousand other useful scientific tasks.

Astronomers at the U. S. Naval Observatory observe the stars in order that our watches and clocks may have the correct time. Meteorologists of the U. S. Weather Bureau observe and forecast the weather for farmers, aviators and city folks. U. S. Bureau of Mines engineers by experiments, practical and theoretical, safeguard and develop the mines of the nation.

The appropriations for such scientific research functions of the federal government are the best investments made by the government. The returns to the public in terms of percentage run to figures like 50,000 per cent. instead of the conventional 6 per cent. that bankers have popularized.

True, the profits do not flow back into the U. S. Treasury directly as dollars. The profits are made not by Uncle Sam but by the American public. That is fitting for the business of the government is not to make money, but to undertake functions that benefit the whole people.

Scientific research is often a long-time investment, with the benefits going to our children and their children. It is a safe investment. Unlike bonds of maturity in the year 2000 or later, issued to pay for rails that even now are rusting away, the money spent for fundamental scientific research is a secure investment that will continue to pay public service dividends down through the ages.

If you think of the budget of the U. S. Government as a gigantic pie, the slice that is eaten to provide scientific research and service, which is perhaps the most profitable of its many activities, is so small that it can barely be seen. Of the federal dollar, less than $\frac{1}{2}$ths of a cent is expended for the constructive scientific research and service conducted to the profit of the whole nation.

This 85 hundredths of one per cent. (based on the 1931–32 expenditures) includes all the administrative, clerical and other routine expenses in connection with the government's scientific work. If the salaries of the scientists themselves and the money expended for apparatus, etc., were considered alone, the item would be much smaller, so minute that it would be difficult to find it among the millions upon millions of dollars that pass through Uncle Sam's pocketbook. Obviously the federal budget can never be balanced by eliminating any or all of the scientific work of the Federal Government.

The crippling of an essential scientific investigation or service here and another there may give a feeling of righteousness and go through the motions of cutting down government expenditures, but it will not balance the budget or materially lift the tax burden. The effect will be hardship on the farmer, the manufacturer or the consumer in later years when the much greater direct tax of undone scientific research will be felt.

Not only will the ultimate consumer and future generations lose, but Uncle Sam himself will find his day-to-day routine governmental activities made more expensive if the scientists are fired. In addition to fundamental and applied scientific research, the federal scientific bureaus perform tests that assure that the government gets its money's worth in purchasing supplies, erecting buildings, etc.

If a total is obtained of all the money spent by the government for all kinds of research, education and developmental work, not just scientific research and service, it is found that only 2.7 per cent. of the U. S. expenditures is accounted for. Who then eats Uncle Sam's budget pie?

Wars, past and future, gobble 75.2 per cent. of the federal budget. Warships, soldiers, veterans, interest and retirement of debts from past wars, and their incidentals consumed $3,758,000,000 of the United States 1931–32 expenditures. Compare this cost of warfare and national defense with $42,000,000 for scientific work, both research and service, in 1931–32. Of the 1934 budget presented to Congress last fall, less than $35,000,000 is devoted to scientific research and service.

The legislative, executive and judicial functions of the Federal Government consumed 12.6 per cent. of the 1932 expenditures, and public works in 1931–32 were responsible for 9.5 per cent. of the expenditures.

Meeting the annual bill for profitable scientific research in the United States budget is a relatively small matter from a financial standpoint. The complete elimination of the annual federal investment in scientific research, which is unthinkable, would not help materially in "balancing the budget." The annual *per capita* cost is only about 30 cents. The *per capita* cost of all federal government activities runs from $30 to $40 per year, depending upon what year is taken.

You, as one of 122,000,000 Americans, make your profitable investment in federal scientific research when you smoke five packages of cigarettes (federal tax six cents a package) use thirty gallons of gasoline in your auto (federal tax one cent a gallon); drink two gallons of beer (federal tax $5 a barrel of 31 gallons).

The total cost of scientific research and service in the many government departments is estimated at $34,768,000 in the 1934 budget submitted to Congress last fall. Since then this budget has been deeply cut, of course. The actual federal science expenditures in the peak year 1931–32 were only about $40,000,000.

This bill for some $40,000,000, which will pay immense profits both now and to future generations, could be met by: The cost of a single modern trans-ocean express steamer; the money needed to build four cruisers; one tenth of the annual U. S. tobacco tax; one third of the "pay of the army," which does not include supplies or civilian hire expenditures of the U. S. Army. Less than a tenth of the savings made by President Roosevelt in the veterans economy measures now being put into effect.

For Uncle Sam's annual investment in scientific research and service, for the 30 cents you as a citizen contribute indirectly each year, you and your children will get many dollars of real profit in every-day living, now and in the future. Figures show that typical research projects return profits of some 50,000 per cent., that is $150 for your 30 cents. And the most beneficial returns are those that can not be computed in mere dollars and cents.

Science has revolutionized the modern world. All about us are essentials and luxuries that are newly arisen from the minds of scientists and their laboratories. Millions upon millions of dollars have been created by science for industry.

Important in the progress of science have been the labors of scientists, working day after day for modest salaries in the federal departments of agriculture, commerce, interior, etc., without avaricious thought of personal gain.

As the nation waxed rich, both in money and comfort and health, did it invest an increasing amount of its wealth in scientific research? Did it plow into its science fields, like a good farmer, adequate fertilizer for future years?

Industry has to a large extent been convinced by bountiful returns that applied scientific research pays and pays well. As income to industry rose after the World War, allotments for research increased, but not perhaps as rapidly as the increase in national income. And as the depression began to take its toll upon business, the research staffs were not fired but in most cases they were preserved and even strengthened.

There has been a new rush in research to create new products and materials to replace those affected by the depression, to develop new and cheaper methods of utilizing old materials and making staple articles. Costs have been held within limited budgets through the science and ingenuity of the research staff. Surveys made by the National Research Council show that industry is continuing to a large extent its scientific research activities.

In the reorganization of the federal government now in progress, the same spirit should rule. The cost of all scientific research and its auxiliary services in the federal government is only about $35,000,000 (based on 1934 budget) and this is a mere fraction, seven eighths of one per cent., of the total budget.

In fact, all the educational, research and developmental work of the government consumes only about three per cent. of the federal cost. A smaller percentage is devoted to constructive education, research and development work now than before the World War. In 1910, 5.1 per cent. was spent for "education, research and development." In 1915 it was 5.4 per cent. In 1920 it dropped to 1.3 per cent. due to war costs. Since 1925 it has hovered between 2.5 and 3.2 per cent.

Compare this with the national income of the whole nation, not government expenditures. Figures by the National Bureau of Economic Research show that the national income in 1910 and 1915 was $31,000,000,000 to $37,000,000,000 in round billions, whereas from 1925 to 1930 it varied from about $80,000,000,000 to $90,000,000,000.

FUNCTIONS OF THE ADRENAL GLAND

IMPORTANT new functions of the vital adrenal glands, concerned with vitamin utilization and milk production, were reported by Drs. Frank A. Hartman, J. E. Lockwood and K. A. Brownell, of the University of Buffalo, at the meeting in Cincinnati of the Federation of American Societies for Experimental Biology.

At previous meetings, members of the federation have heard the Buffalo investigators describe the life-saving cortin which they extracted from the cortex part of the two small glands that lie just above the kidneys. Cortin has saved the lives of sufferers from Addison's disease, an ailment in which the adrenal glands are diseased and fail to produce enough cortin themselves for the body's needs. Animals deprived of their adrenal glands quickly die, but their lives may be prolonged indefinitely by administration of cortin.

Experiments were reported suggesting that adrenal cortical extract, possibly cortin itself, helps the body to utilize vitamins C and B_1. A substance that is necessary for the production of milk has been separated from cortical extract. They call this new hormone cortilactin.

The discovery of the relation of cortin to vitamin utilization came about when microscopic changes were found in adrenal gland cortex of animals getting too little of certain vitamins in their diets. This suggested that extra

demands were being made on the glands to make up for the vitamin deficiency.

When an extract containing cortin was given to guinea-pigs on vitamin C deficient diets, the onset of scurvy was delayed. The extract was prepared in such a way that none of the vitamin, which itself prevents scurvy, could have been present. Injection of this extract also delayed the onset of nerve symptoms due to deficiency of vitamin B_1 in the diet.

Apparently this function of the adrenal gland cortex is so important that provision is made for one gland to produce more of the substance concerned in vitamin utilization in case of injury to the other gland. This extra production on the part of the remaining, healthy gland is continued for about five weeks after disease or injury has put the other out of action.

Discussing the milk-producing hormone, cortilactin, Dr. Hartman and associates explained that cortin alone does not have this action. Mother rats that have no adrenal glands can not raise litters of young, even with enough cortin to keep the mothers themselves healthy and fat. Cortilactin must be added.

INHERITANCE AND GLANDS IN THE CONTROL OF GROWTH

CONSTITUTIONAL, inherited factors have more to do with type of body build than secretions of the body's powerful, growth-controlling glands, it appears from breeding experiments with dogs reported by Dr. Charles R. Stockard, of Cornell University Medical College, at the meeting in Cincinnati of the American Association of Anatomists.

Secretions of certain glands, notably pituitary and thyroid, are known to affect growth because when too much or too little of the powerful hormones are secreted the results may be seen in dwarfs, giants and other abnormal bodily forms.

While admitting the power of the glands over growth, Dr. Stockard believes his experiments show that the gland secretions are quite unable to regulate growth in opposition to the inherited constitution of the individual.

"For illustration," he said, "ordinary persons may not respond in their growth reactions to pituitary modification in the same manner as do those inheriting acromegaly."

Acromegaly is a disease in which the bones and the soft parts of the hands, feet and face are enlarged. The disease is associated with over-function of the pituitary gland.

According to Dr. Stockard's theory, over-functioning of the pituitary would not produce the enlarged bones typical of acromegaly in the ordinary person, but only in persons inheriting acromegaly.

Dr. Stockard has for many years engaged in breeding experiments with dogs and has learned much of how various traits are inherited. By crossing various breeds, he has found which characteristics are dominant characters that will appear in every generation, and which are due to glandular conditions.

ITEMS

A SPECIAL balloon now under construction in Leningrad will be used by Soviet investigators in an attempt to set a new altitude record by penetrating into the stratosphere, in order to study electric and magnetic phenomena, cosmic rays and solar energy in the upper reaches of the atmosphere. The closed passenger car, which will be attached to the balloon, will have walls 10 mm (two fifths of an inch) thick. It is being constructed of a specially strong non-magnetic alloy which has been perfected by a group of specialists working under the guidance of Engineer Vasionko.

DEFINITE evidence of an anti-growth factor in the parathyroid gland has recently been found by Drs. C. J. Eastland, N. Evers and J. H. Thompson, working at Kings College, University of London, and the Royal College of Surgeons. These investigators treated fresh parathyroid gland in a special way and obtained an extract which had a harmful effect on the growth of rats, according to a report in *The Biochemical Journal*. Six rats were used as controls, and six were given daily injections of a small measured amount of the extract, other conditions being the same for both groups of rats. The factor which retarded the growth was destroyed by treatment with hydrogen peroxide.

BITTER rubberweed, a plant belonging to the aster family, has been growing into a serious problem to sheep raisers in a part of western Texas, according to A. B. Clawson, physiologist of the Bureau of Animal Industry. Due apparently to over-use of the grazing land and to climatic factors, the weed has been increasing in abundance while good forage plants have been growing scarcer, with the result that the poor sheep have been driven to this poisonous food. It is estimated that 75,000 of them died in an area of 6,000 square miles during the winters of 1929–30 and 1930–31. The cause of the sheep losses was not at first known, but because of the abundance of the bitter rubberweed in the affected area it was placed under suspicion, and an investigation by scientists of the U. S. Department of Agriculture resulted in its conviction. The plant is known to botanists as *Actinea odorata*.

SEVERAL of the larger German cities are solving part of their depression problems by a hook-up of garbage-burning plants and greenhouses. Unemployed men are given jobs building greenhouses and running the incinerators. Ashes from the burned garbage are used as fertilizer, and heat from the incinerators keeps the greenhouses warm. Plants that thrive on high-potash fertilizers, like tomatoes, cucumbers and cut flowers, are grown in the greenhouses. H. A. Kirsch, a Berlin engineer who describes the projects in *Die Umschau*, states that employment in building will be given to about 25,000 men, and that for running the finished establishment two or three thousand families can be crossed off the rolls of those receiving public aid. The projects are expected to be self-liquidating, in that they will supply large quantities of high-grade fresh vegetables that have hitherto had to be imported.

SCIENCE NEWS

Science Service, Washington, D. C.

THE REPRODUCTION OF MUSIC BY NEW METHODS

THREE loud-speakers on an empty stage, three telephone lines running to three microphones in a sound-proof room containing the Philadelphia Symphony Orchestra, Leopold Stokowski turning electrical control knobs instead of wielding a baton, telephone engineers operating the electrical circuits, was the most advanced development of musical reproduction that will be introduced to the public in a Philadelphia-Washington concert for the National Academy of Sciences on April 27.

In a private preview for scientists and music critics held at the Academy of Music in Philadelphia, the American Telephone and Telegraph Company engineers demonstrated the results of two years of scientific research conducted with the collaboration of Director Stokowski. Wagnerian music was played with whispering pianissimos and thunderous crescendos hitherto unheard by human ears. Stokowski by the turn of a control knob could subdue his orchestra, isolated in another part of the theater, to a mere trickle of sound or he could build up their music to the sound of two thousand musicians at a peak of output. Brünhilde, sung by Miss Agnes Davis, became an electrical supervocalist, rising above the orchestral accompaniment of Götterdämmerung. Wagner's music was rendered as probably he never dared to dream it might be played.

This merging of music and telephone science has introduced jointly three factors in the electrical reproduction of orchestral music: (1) auditory perspective; (2) tone and overtone control; (3) volume control. Three loud-speakers at left, right and center of the empty stage, each connected with a similarly placed microphone on the remote stage of the actual performers, give perspective to the music and sounds. Musicians could tell just where the violins or horns were placed. In one demonstration, stage hands moved across the distant stage and the audience of the empty stage "followed" them about the empty stage by using their ears. Engineers had previously felt that this illusion of auditory perspective might be obtained only with many loud-speakers on the empty stage, but three were found to give perfect results when the electrical transmission had high quality.

A wide range of nine musical octaves, from three below middle C to nearly six above, was utilized for the first time in electrical transmission of music. This corresponds to all frequencies from about 35 cycles per second to about 16,000 cycles per second. Radio by federal regulation is limited to a band of 5,000 cycles per second. When experimentally the high and low frequencies are chopped off by electrical filters the damage to the tone and overtone qualities was readily apparent. Each of the three telephone wires carried the full range of frequencies, and the frequency channels utilized therefore were roughly nine times those of the most perfect radio transmission. In loudness range, the orchestra or other sound being transmitted can be varied from an output equivalent to a millionth of a watt to a sustained hundred watts and even a kilowatt at momentary peaks without distortion. The sound in the demonstration was raised from the rustle of leaves to beyond that of a roaring airplane engine.

Practical applications are foreseen by the telephone engineers and Director Stokowski. A symphony orchestra in one place may render its concerts with perfect tonal quality and with improved volume in a hundred or a thousand different halls in distant cities. Music may be spread from high towers so that 100,000 may enjoy it in large parks. The musician and composer can add electrical amplification and control to his material out of which beautiful sound compositions are wrought.

PAPERS AT THE CINCINNATI MEETING OF THE FEDERATION OF AMERICAN SOCIETIES FOR EXPERIMENTAL BIOLOGY

PROGRESS toward isolation and laboratory preparation of the life-saving hormone of the adrenal gland cortex and a tentative chemical name for it were reported from two research centers. This hormone has proved valuable because its use prolongs lives of patients suffering from the hitherto incurable Addison's disease. From the gland itself, Drs. Arthur Grollman and W. M. Firor, of the Johns Hopkins University, have extracted a crystalline substance that is so very powerful that it is probably the pure hormone. However, Dr. Grollman stated that several more years of investigation will be needed to make sure of this point. The chemical composition of this substance has been investigated at the Mayo Clinic by Dr. E. C. Kendall, H. L. Mason, B. F. McKenzie and C. S. Myers. Dr. Frank Hartman, of the University of Buffalo, a pioneer investigator of this hormone, had suggested the name cortin, spelled without the final e, and Dr. Kendall's research into its chemical nature shows this to be a suitable name with the addition of the final e, which indicates the presence of nitrogen. Dr. Kendall and associates are trying now to produce the hormone from the chemicals in their laboratories, and while they have not yet synthesized the entire compound, they have succeeded in obtaining a preliminary compound.

A NEW hormone of the pituitary gland that exercises control over the thyroid and seems to "double" for the secretion of that gland causing exophthalmic goiter was a leading topic of discussion among medical investigators. As one doctor expressed it: "The pituitary gland is in the driver's seat." It is small but important, located at the base of the brain. It produces many powerful hormones or chemical regulators of the body's activities. Some of these hormones have an important stimulating effect on the sex glands. Another hormone promotes growth. The latest discovery is a new hormone

that influences the secretion of the thyroid gland. Exophthalmic goiter, characterized by extreme nervousness and protruding eyes, results from over-secretion of the thyroid gland. Now scientists have found the newly discovered pituitary hormone can produce the same effect. For the first time scientists have been able to produce this type of goiter in animals, which will greatly aid further research on this serious and wide-spread disease for which the only relief at present is surgical operation.

THE "chemical dissection" of a gland has been accomplished by Drs. J. B. Collip, D. L. Thomson, H. Selye and E. M. Anderson, of McGill University. The gland is the pituitary, located at the base of the brain, and apparently possessed of far greater powers than hitherto supposed. This gland secretes a number of hormones, powerful chemical regulators of body activity. One investigator estimated that twenty-two pituitary hormones had been reported by various investigators. Dr. Collip and his associates are working to get clean hormone extracts from this gland, each separate from the other, and to determine the exact effect of each on the human body. In his pocket, Dr. Collip carried a tiny bottle containing a clear, colorless fluid. One cubic centimeter, or about four drops, of this particular pituitary hormone is sufficiently powerful to produce exophthalmic goiter in two hundred guinea-pigs.

THE parathyroid glands, located next to the thyroid gland in the neck, probably play an important rôle in the mechanism which sets free the rickets-preventing vitamin D from the skin and the tissues just under the skin, according to Dr. F. L. Kozelka, of the University of Wisconsin. Investigators have believed for some time that the ultra-violet rays of sunshine change a fatty substance, ergosterol, found in the skin and subskin tissues, into the vitamin. The parathyroid glands apparently make the next move by liberating the vitamin from the tissues so that it in turn can play its part in the body chemistry.

CAUTION against too large doses of viosterol, artificial vitamin D which is widely used as a preventive of rickets in babies, was urged by Dr. Agnes Fay Morgan, of the University of California. Dr. Morgan and associates reported a new method of studying bones to find out how they were affected by vitamin D. Dr. Morgan's studies with rats have convinced her that the largest safe dose of viosterol is very much less than previously supposed. Overdoses of this substance seem to produce kidney injury, which Dr. Morgan believes is the cause of death of animals receiving too much viosterol. She emphasized that it is unwise and unsafe for mothers to buy this potent substance and give it to their children without a physician's directions as to the amount of the dose.

THE dye, methylene blue, which has been widely heralded as an antidote for deadly cyanides and carbon monoxide gas, may kill people instead of saving their lives when used to treat victims of carbon monoxide, Professor Yandell Henderson, of Yale University, reported. In his laboratories at Yale, Professor Henderson said, Dr. Howard W. Haggard has been using the dye to treat dogs that were near death from the effects of the invisible carbon monoxide gas which is found, among other places, in the exhaust gas of automobiles. The dogs would have recovered with the usual treatment for carbon monoxide poisoning. They had been exposed to the gas in amounts just short of that which causes death. When given methylene blue treatment, instead of recovering, they died. This investigation has brought out plainly that what the dye really does, Professor Henderson commented, is to convert the oxygen-carrying hemoglobin of the blood to methemoglobin. This compound is powerless to supply oxygen to the tissues and the victim then dies of asphyxia. Carbon monoxide kills in the same way, the gas forming a strong chemical union with the hemoglobin and thus preventing it from carrying oxygen to the tissues.

A FUNDAMENTAL difference between the sexes in the way the body takes care of the sugars and starches of the diet was reported by Dr. H. J. Deuel, Jr., of the University of Southern California. Fasting adult male rats had more sugar stored in their livers than did the females, Dr. Deuel and associates found, while the females had more fat stored in the liver than the males. There was no difference in immature rats. Dr. Deuel was trying to find why women develop a condition of much greater acidosis during fasting than men do. Apparently it is because of their smaller store of sugar and larger store of fat. The problem is important in connection with diabetes in which this kind of acidosis develops when the patient is on a sugar-free diet. It indicates that diabetic women might need a slightly different diet from diabetic men. When the ovaries were removed, female rats had as much sugar stored in their livers as did normal males, Dr. Deuel found. When these rats were given doses of theelin, a female sex hormone, the sugar stored in their livers was the same amount as that of normal females.

SCIENTISTS whose knowledge of nutrition taught us how to feed our fighting men during the World War are now turning their knowledge to the problem of feeding the soldiers of the depression. The fight to-day is against the "undisclosed signs of deterioration" in health resulting from malnutrition, Professor Lafayette B. Mendel, of Yale University, pointed out at the meeting. Disease due to lack of proper foods grows slowly. Scientists are trying now to recognize these diseases in their very earliest stages, just as bankers are trying to find ways of detecting unsoundness in banks early enough to prevent disaster. Early signs of the beginning of these diseases could be seen last year in the bread lines, Professor Mendel said, and on the hands of patients admitted to the wards of Bellevue Hospital in New York, doctors saw the faintest marks on the skin which meant the beginning of pellagra. In this fight we need the help of the family physician who knows his patients well enought to see the development of what Professor Mendel called "subvisible disorders."

LOOKING through a window in a rabbit's ear, University of Pennsylvania physiologists have gained a better understanding of how the body disposes of débris cast out of the blood vessels. This has been one of the important problems still unsolved by physiologists. Drs. E. R. Clark and E. L. Clark reported their observations at Cincinnati. Lymphatic tissue, which has been credited with doing this scavenging job, appears to be much less important in this relation than previouly thought, the Clarks' study showed. Enzymes which digest protein substances may play a rôle in the scavenging process, it was suggested. The window in the rabbit's ear was devised several years ago at the University of Pennsylvania laboratories. It is a sort of double window composed of two thin sheets of transparent substance, with the space between thin enough so that light can pass through the tissues that grow into it. A microscope was used to look through this window and watch what goes on in blood-vessels, the blood itself, the connective tissue and other kinds of living material.

EVIDENCE that stomach ulcers may result from diets lacking in vitamin A was presented by Dr. Ira A. Manville, of the University of Oregon Medical School. Dr. Manville reported that white rats fed a diet deficient in vitamin A developed stomach ulcers and erosions. Nearly two thirds of all the animals fed on diets that were deficient to various degrees in the vitamin showed these sores. As the vitamin deficiency became more severe, the number of animals affected became greater until nearly 100 per cent. were found to have ulcers. Vitamin A, found in liver, butter, egg yolk, cheese, cod-liver oil, spinach and the leaves of plants, is necessary to promote normal growth. In its absence growth is stunted and a severe eye disease develops. This vitamin is also considered necessary for normal functioning of the mucous membrane of nose, throat and breathing apparatus, and urinary and gastro-intestinal tracts. In this connection it has been claimed that vitamin A will prevent colds.

THE warfare and strategy that goes on in the human body when the blue dye, methylene blue, is called in to fight poisonous cyanides was revealed in a report by Dr. William B. Wendel, of Washington University School of Medicine. Dr. Wendel's study showed that methylene blue can only win the fight for life against the poison when the dose of cyanide is not great. Successful use of the dye as antidote in a case of cyanide poisoning was reported last fall by Dr. J. C. Geiger, San Francisco director of public health. The antagonistic action of the dye for cyanides has been observed by a number of scientists. Mrs. Matilda M. Brooks, of the University of California, claims to have first suggested its use as an antidote in poisoning and suicide cases. Cyanides cause death by suffocation, since they interfere with the supply of oxygen to the tissues. Methylene blue fights cyanides by converting some of the oxygen-carrying hemoglobin of the blood into a new chemical compound, methemoglobin. This new compound is able to force the cyanide out of combat by uniting with it to form the chemical union, cyan-methemoglobin, which is harmless itself, and which keeps the cyanide from interfering with the vital, oxygen-carrying activity of the rest of the blood hemoglobin.

PROGRESS in the search for a new, safe morphine was reported by Dr. Nathan B. Eddy, of the University of Michigan. Dr. Eddy is engaged in research sponsored by the drug addiction committee of the National Research Council. The object of the research is to produce, if possible, a substitute for morphine which will have that drug's valuable pain-relieving and sleep-inducing qualities, but none of its dangerous habit-forming propensity. The morphine molecule consists of a number of chemical units arranged to form a series of rings. Among these two units, known as hydroxyl groups because they are made up of hydrogen and oxygen, are appended to the rings. At present, Dr. Eddy is trying to find which of the units is responsible for relieving pain, which for quieting nerves and inducing sleep, and which for the sense of well-being that leads to habit-formation. He reported that the two hydroxyl groups have opposite effects in the action of morphine in the body. One of them increases the pain-relieving and other useful properties of morphine, while the other hydroxyl group decreases the same properties.

ITEMS

FINAL proof that the yellow fever mosquito, *Aedes aegypti*, can transmit a serious epidemic disease of horses and mules, popularly known as Kansas-Nebraska horse plague, has been obtained by Major R. A. Kelser, of the Veterinary Laboratory Division of the Army Medical School. The proof was obtained when a horse, on which infected mosquitoes had been feeding, developed symptoms of the disease and became seriously ill. A short time ago Major Kelser reported that the yellow fever mosquitoes had spread the disease among guinea-pigs, which implicated them as possible carriers of the disease among larger animals. At that time, however, the horse on which he had fed the infected mosquitoes had not yet developed the disease. Major Kelser's investigations also showed that the mosquito is not a mechanical carrier of the disease, but that the virus of the disease undergoes a change in the mosquito's body.

FEWER children are being killed by automobiles now than any time in the last ten years, according to statistics published by the Metropolitan Life Insurance Company. The decrease in the number of child automobile deaths began in 1930. "The year 1932 was the third successive year in which there had been a considerable drop in the death-rate of children from this cause." This gratifying reduction in automobile accident deaths of children is attributed to the safety campaigns that have been waged by schools, police departments, insurance companies and women's organizations. Along with the marked reduction in the number of child victims, there has been a decline in the total number of automobile deaths during 1932.

SCIENCE NEWS

Science Service, Washington, D. C.

THE PREVALENCE OF LEPROSY

"LEPROSY is increasing in many parts of the world by leaps and bounds." This startling declaration, made by Dr. O. E. Denny, director of the U. S. Marine Hospital at Carville, Louisiana, national leper home, needs some qualifying, Dr. Denny explained in a Science Service interview.

Dr. Denny discussed the leprosy problem at the meeting of the medical board and the advisory committee on research of the Leonard Wood Memorial, a fund supported by the American public and devoted to the study of the nature and treatment of leprosy.

The number of known cases of leprosy is increasing in many countries, according to Dr. Denny. In the United States, for example, each year more cases are discovered and segregated. But there are probably no more cases of the disease now than there were twenty-five years ago. The apparent increase, that is, the increase in reported cases, is due to the fact that doctors are learning more and more to recognize cases of leprosy and to diagnose it correctly.

In India, for instance, there were about 300,000 recognized lepers about fifty years ago. Now there are between one and three million recognized lepers in that country. Whether this enormous increase is real or is apparent and due to better diagnosis and reporting is not known. Probably the increase is only apparent.

In one or two countries there is an actual increase in leprosy. In South America, authorities are concerned over the situation. In Argentina, where there was no leprosy to speak of twenty-five years ago, it seems to be increasing in actual fact. A possible explanation may be that more and more remote mountain villages and their Indian inhabitants are coming into contact with the larger towns and with civilization. Leprosy is to some extent a disease of civilization, and it is being spread as commerce grows between the remote villages and the larger towns where a few cases of the disease exist and where the Indians may come in contact with it for the first time.

In the South Pacific, in one or two of the very small islands, leprosy also is increasing and here, too, Dr. Denny believes that the increase is a real one. The largest of these islands is Naru. The population of each is only about 100 or 200. Here, with a very small increase in population, there has been a very sharp increase in leprosy during the last ten years. Twenty-five years ago, there was no leprosy on these islands. Now physicians making medical inspections are finding it and reporting it in the medical journals. The situation is, however, not alarming.

FUTURE RESEARCH ON FOOD AND DIGESTION

NEW goals for investigators to reach in their studies of food and its digestion were set by Professor Lafayette B. Mendel, of Yale University, at the closing session in Cincinnati of the Federation of American Societies for Experimental Biology.

Ten major problems in nutrition are awaiting solution, it appeared from Professor Mendel's remarks. These are:

1. The fate of the fats in the body. This foodstuff commonly constitutes one third of our daily food fuel intake, but no satisfactory or adequate balance sheet has ever been made to account for it all. Some is used for fuel, some is stored, some is excreted, but there is a missing fraction not yet accounted for.

2. The fate of the nitrogen-containing foods. The state of knowledge concerning these important foods, more familiarly known as proteins, is nearly as unsatisfactory as in the case of the fats.

3. An appraisal is needed of the relation of the minerals in the diet to such factors as vitamins and internal secretions.

4. The possible value of a number of pigmentary substances, such as chlorophyll, the green coloring matter of plants, needs to be investigated, now that another such substance, carotene, has been found important in connection with vitamin A.

5. Glandular foods, like liver, kidney and thymus, have a new significance in the diet since the discovery of their value in pernicious anemia, and they should be investigated further.

6. Further study of vitamins is required to complete our knowledge of these important factors.

7. The problem of alcohol as a food will probably be revived for further study.

8. Dropsy as a result of faulty diet presents a relatively new problem for investigation.

9. The rôle played by the organic acids of vegetables, such as citric, malic, tartaric and oxalic acids, which must be taken in considerable quantities in the ordinary diet, needs to be discovered. Vegetables themselves are claimed to have unique advantages in the diet. "Our knowledge of what actually happens to them chemically in the long reaches of the alimentary tract is woefully limited," according to Professor Mendel.

10. The way in which products of digestion are transported to other parts of the body deserves further scientific consideration.

In the future, scientific students of nutrition will solve problems such as these, which relate not so much to the composition of the foods we eat or to their effect on the body as to their actual fate in the chemical factories of the digestive tract.

"UNSALTING" THE GREAT SALT LAKE

THE Great Salt Lake of Utah, remnant of the prehistoric Lake Bonneville, is at last to be put to some practical use.

Scientists and engineers have perfected a method for "unsalting" a great part of it, and then harnessing it for the production of electrical power. In its present

state—seven times as salty as the sea—the lake is a dead loss in a very live world.

"Unsalting" the Great Salt Lake is not so impractical as it at first seems; the idea was, in fact, long ago advanced by the French engineer, Ferdinand de Lesseps, and it has been accepted as feasible after a series of detailed surveys and laboratory tests. The diking project involves these basic elements:

1. Diking off an initial area of 146 acres.
2. Providing sluiceways to insure continuous flow of water over the dikes.
3. Allowing sufficient time for displacement of brine by fresh water.

This last point is the problematical one. R. A. Hart, engineering expert of the Salt Lake Chamber of Commerce, has demonstrated to his own satisfaction that the initial area will be fresh in two years. Some investigators in Utah disagree with him.

The most difficult feature of the project is the erection of dikes sufficiently strong to stand the battering of the heavy water. The plan is for dikes of the earth-fill type, with a very gentle slope—about 15 to 1—and a maximum distance through the base of 500 feet.

Nature has already laid the main link in the dike system. This is Antelope Island, which lies in a north and south position just west of the eastern shore. From the extremities of this island will be built the dikes, one five and a half miles long, the other two and a half. Thus the embayed area will be fed by two or three streams which will—in time—displace the brine which to-day is unusable for steam power plants.

A million dollar loan for the project is being sought from the Reconstruction Finance Corporation.

THE FLOOD SITUATION

FLOOD stages in rivers of East and South, following recent rainy weather over most of the country east of the Rockies, were reported in a summary of the flood situation given to Science Service by M. W. Hayes, of the U. S. Weather Bureau.

In New England, the Connecticut and the Merrimac were characterized as in "rather high flood"; the highest in several years.

The Ohio and some of its tributaries are up, though not so high as they were a short time ago. The Ohio itself is rising slightly, though still well below bank-full above the mouth of the Kentucky River; from there to Paducah, Kentucky, it is due to rise again to flood stage, though not so high as it did a month ago. The Wabash is at flood stage.

The Mississippi is falling slightly above the mouth of the Ohio; below that point it is still swollen with the recent flood, although the state of the lower river is not at all serious. An upper tributary, the Illinois River, is out of its banks. A lower tributary, the Yazoo, in the State of Mississippi, is quite high; it has established a record for this late in the season.

The James, in Virginia, and the Neuse, in North Carolina, are high, but their waters are receding.

The Missouri and other rivers of the Northwest are making no trouble at all just now. The Missouri, in fact, is at a relatively low stage.

CELLOPHANE AND THREE-COLOR PHOTOGRAPHY

THREE-COLOR photography is making rapid strides toward perfection with the aid of that versatile material Cellophane.

In the photographic laboratory on the top floor of the Army Medical Museum, R. M. Reeve has been working quietly for almost a year on a color process using Cellophane sheets. The latest products of his experiment are pictures of flowers, people, scenery, diseased body tissues, all so natural in their colors that the photographs seem like fine and extraordinarily accurate water colors. The new photographic process may in some cases replace the work of water-color artists who copy scientific material.

The process is being perfected with a view to obtaining a government-owned patent. The cost of the process is reasonable.

To take the pictures panchromatic plates or films are exposed in the camera. One records the yellow color in the subject before the lens. Another film records greenish-blue. A third records red, which is really almost purple. At present, it is necessary to expose the three-colored films in succession. Mr. Reeve hopes eventually to perfect a tri-pack film which will "shoot" the three colors at once. Three prints are then made on correspondingly dyed Cellophane sheets. Each sheet has been impregnated with a different solution. While still wet, they are placed one over the other so that the picture coincides. The whole three-layered Cellophane picture is then fastened with adhesive to a paper backing and dried.

With all due care, Mr. Reeve says, film negatives taken separately sometimes turn out to be slightly different in size. In former three-color processes, this produced blurry outlines when the colors were assembled to make the picture. Cellophane, when wet, however, is flexible and can be stretched until the outlines coincide exactly.

The Cellophane films record very exactly the fine shadings of color in diseased tissue and other medical subjects. Photographs turned out by the new process are now being used at the Army Medical School in the form of colored lantern slides. Others have been placed on exhibit in the Army Medical Museum.

The Department of Agriculture is looking into the possibilities of the color picture for use in its exhibits and publications.

FUEL CONSUMPTION

INCREASES in the efficiency of using coal and oil may prevent increases in the annual consumption of these fuels in the United States during the next twenty years, is pointed out by Professor W. T. Thom, Jr., of Princeton University, in commenting on a recent estimate of fuel consumption for the future, which postulated an approximate doubling of fuel consumption in the United States by 1950.

Pointing to the relatively small increases in the amount of fuel used to produce power and useful energy during the boom period culminating in 1929, Professor Thom stated that it seems entirely possible that, even if our national energy requirements increase, we may, nevertheless, be able to supply a growing demand for energy,

without a corresponding increase in amount of fuel used, and possibly without any increase.

Commenting upon recent estimates of fuel consumption made by Professor W. Spencer Hutchinson, of the Massachusetts Institute of Technology, and August J. Breitenstein, Ashland, Pennsylvania, engineer, Professor Thom calls attention to the fact that really to be able to predict future fuel consumption, one must first be able to predict both the degree of prosperity which our domestic industry will enjoy, and how long the present business depression will last. As he explains, a period of acute trade depression fosters the introduction of radical departures in fuel saving economy as a means of cost-cutting. Such measures of fuel economy continue in use thenceforth, possibly causing a progressive reduction in the amount of fuel used, even while power output may be increasing.

In commenting on the use of population statistics as a basis for estimating our future national energy requirements, Dr. Thom further explains in a communication to the American Institute of Mining Engineers, that one may go astray by considering the population of the United States alone. With the free outflow of manufactured exports, our consuming population is to all intents and purposes greater than our national population, whereas, if prohibitive tariffs are in force against American goods seeking to enter other countries, then this foreign addition to our domestic energy-consuming population is unavailable and our fuel consumption is correspondingly lessened.

ITEMS

AN increase in the number of meningitis cases throughout the country has been reported to the U. S. Public Health Service. Health officials see in the situation a possible problem for the forestry camps where large numbers of young men will be concentrated. In all mobilizations of young men heretofore there has always been an increase in meningitis. The only known precaution that can be taken to prevent an outbreak of the disease in these camps is to avoid crowding in the sleeping quarters. Reports from state health officers for the week ending April 8, gave a total of 92 cases of meningitis. The total was 69 for the corresponding week of 1932. Since the first of March the number of cases reported in 1933 has been greater than in the corresponding period of 1932. This may indicate the beginning of another outbreak of the disease or it may be due to the fact that the year 1932 was unusually healthy. The 1933 figures may be nearer to the usual ones for the prevalence of this disease.

THAT oxygen in three to four and one half times the usual percentage in the air mixture breathed during muscular work seems to offer no advantages is shown by experiments by Dr. Francis G. Benedict and Robert C. Lee, of the Nutrition Laboratory of the Carnegie Institution of Washington, reported before the meeting of the American Philosophical Society. Volunteers were used who breathed ordinary air containing 21 per cent. of oxygen during part of the tests, while the rest of the time they were supplied with air mixtures containing from 60 to 90 per cent. No significant alteration was found in the total oxygen consumption per minute for the same amount of work. Neither was there any change in the ratio of oxygen used to carbon dioxide exhaled, thus indicating no change in the character of the material burned in the body. Finally, the oxygen absorbed during the recovery periods after work remained unchanged.

FAINT radiations from the night sky, not perceptible to human eyes but detected and analyzed by the spectrograph, were termed "cosmic radiations of the sky" by Dr. V. M. Slipher, director of the Lowell Observatory at Flagstaff, Arizona, speaking before the society. The radiations extend throughout the spectrum from ultraviolet to deep infra-red, generally stronger in the longer wave-lengths. Other illuminations from the night sky intercepted by Dr. Slipher's instruments have included light from auroral displays and the brief morning and evening twilight solar stimulation in the high atmosphere.

WHY plants growing in bogs, where there is always plenty of water, should have thick, tough, leathery leaves protected against evaporation, resembling desert plants in this respect has long been a puzzle to botanists. Dr. Kurt Mothes, of the University of Halle, believes he has found a possible key in the lack of nitrogen in bog water and soil, rather than anything to do with the water relationship itself. He was struck by the fact that of all bog plants the sundews, which capture insects with the sticky fingers on their leaves and thereby get plenty of nitrogen, are the least desert-like in their appearance and structure. The same might be said of two groups of American insectivorous plants, the Venus flytrap and the pitcher plants. To test the possibilities of his hypothesis, Dr. Mothes grew tobacco plants, which normally are anything but desert-like, in culture solutions containing plenty of other mineral nutrients but lacking in nitrogen. They responded by developing thick, tough, leathery leaves, with small stomata or "breathing pores" and other characteristic structures of desert plants. The full technical discussion of Dr. Mothes' experiments is published in the *Biologisches Zentralblatt.*

MALARIA has been completely routed from the Italian province of Istria, at the head of the Adriatic, by a million and a quarter little American fishes, in a campaign that has lasted for seven years. Dr. Massimo Sella, Italian director of the Italo-German Institute of Marine Biology at Rovigno d'Istria, tells how. When the work was started seven years ago, he says, the prospects were downright dismal. In the region around Rovigno there were over 800 mosquito-breeding ponds, and 94 per cent. of the population showed symptoms of malaria. But every year some 200,000 of the American top-feeding minnow, species Gambusia, were dumped into some of the ponds, while the others were treated with Paris green. The "wigglers" were eaten by the little fish or killed by the poison. In 1927 there were still 147 ponds harboring mosquito larvae; in 1931 only 7; in 1932 none whatever. For the past two years no one in the region has shown clinical symptoms of malaria. The little American fish have scored another victory.

SCIENCE NEWS

Science Service, Washington, D. C.

THE ENERGY CONTAINED IN COSMIC RAYS

By WATSON DAVIS, *Managing Editor*

COSMIC rays, totally unknown a few decades ago, are now recognized to comprise the greater portion of the radiant energy of the universe, Dr. Robert A. Millikan, of the California Institute of Technology, told the National Academy of Sciences at its annual meeting in Washington.

As the result of new researches with sounding balloons and airplanes this past year, Dr. Millikan and his associates have determined with great accuracy the way in which cosmic rays vary downward from nearly the top of the earth's atmosphere. The recent experimental results, combined with the findings of Dr. Millikan and other experimenters in past years, allow Dr. Millikan to conclude that the total radiant energy in our galaxy in the form of cosmic rays is nearly the same as that in all the other forms of radiation, such as light and heat emitted by stars.

In the immense spaces between the galaxies of stars the starlight and heat must diminish to a small amount of that found in our own Milky Way galaxy, but the cosmic radiation coming to the earth from far beyond our neighbor stars, from the depths of the universe, must be even greater in intensity in intergalactic space. In this way Dr. Millikan concludes that cosmic radiation forms the greater part of the radiant energy of the universe.

One of the sounding balloons launched by Dr. Millikan and Dr. I. S. Bowen reached a height at which only a half of one per cent. of the atmosphere's weight remained above it, equivalent to about 20 miles altitude (16 millimeters of mercury pressure). The cosmic ray electroscope record obtained was reliable up to nearly that height, to within about 92 per cent. of the top of the atmosphere. One other balloon flight, carrying the remarkably light, automatic instruments to great heights in the stratosphere, agreed closely with the record flight and the two checked closely the results of a similar sounding balloon ascension made at the same time (last summer) by the German physicist, Regener.

With a cosmic ray electroscope, devised by Dr. H. Victor Neher, which records accurately and automatically under the strenuous conditions of rushing auto, railroad train or airplane, measurements of cosmic ray intensity have been made at altitudes up to 29,000 feet, nearly six miles. U. S. Army bombers and pursuit planes carried the instruments aloft first without screening and second screened by a shield of lead of 10 centimeters' thickness at several localities in the United States and at Panama, while commercial planes were used in experiments 17 degrees below the equator in Peru.

The results of these airplane tests bring to light the fact that cosmic rays grow rapidly softer or less penetrating as altitude increases. This softening is so marked that more than 75 per cent. of the rays existing at altitudes of 25,000 feet have insufficient energy to penetrate four inches of lead. As Dr. Carl D. Anderson in Dr. Millikan's laboratory has measured the loss of energy of cosmic rays passing through lead, Dr. Millikan can conclude that more than three fourths of the cosmic rays at 25,000-foot altitudes have energies of less than 350,000,000 volts. But particles of this voltage can not penetrate more than half of the depth of the atmosphere, and Dr. Millikan concludes that the experiments furnish convincing proof that the cosmic rays found at low altitudes are certainly secondaries which are formed in the earth's atmosphere by collision with air atoms. Photographs taken by Dr. Anderson have caught the cosmic rays, which are non-ionizing and can not be photographed themselves, in the act of smashing atomic hearts and letting loose positively and negatively charged particles.

Dr. Millikan concludes that his researches present strong evidence that all but a small fraction of the cosmic rays observed at sea-level by cosmic ray counters and other devices used by other investigators are secondary rays produced within the earth's atmosphere.

Most of the cosmic rays, then, according to his interpretation, enter the atmosphere as photons or radiation-like light, x-rays or radium's gamma-rays, not as charged particles, like electrons or positrons. The new airplane experiments also lend support to Dr. Millikan's theory that the total cosmic ray curve is to be explained by not less than three and probably four or five cosmic ray bands, corresponding to different colors of light in the visible spectrum. Those rays that reach only the upper part of the atmosphere are, he finds, with energies less than some 75,000,000 volts.

Dr. Millikan's experiments were supported by funds of the Carnegie Corporation administered by the Carnegie Institution of Washington. In the sounding balloon experiments he had the full and effective cooperation of the U. S. Weather Bureau, and in the airplane test the equally effective cooperation of the U. S. Army Air Force and the Royal Canadian Air Force.

RADIATION OF THE NIGHT SKY

THE night sky glows with a faint light that seems to come from nowhere. It certainly is not made of scattered starlight, for it is richest in wave-lengths of the red and infra-red regions of the spectrum, whereas scattered starlight is poorest in exactly these rays. This sky radiation has been called the "cosmic radiation" of the night sky by Dr. V. M. Slipher, of the Lowell Observatory, Flagstaff, Arizona, who reported on his long study of the subject at the meeting in Washington of the American Geophysical Union.

This designation, however, should not be confused with the cosmic radiation proper, which consists of extremely penetrating rays or particles studied by Hess and Kolhoerster in Germany, and by Millikan, Compton and Swann in this country. The cosmic radiation proper

almost certainly comes from outer space, whereas the sky rays studied by Dr. Slipher are almost as certainly the product of the earth's atmosphere, excited into faint luminescence by radiation from the sun.

Dr. Slipher's sky rays range through the entire gamut of wave-lengths from ultra-violet to infra-red, though some of the colors are stronger than others. He spoke of a prominent yellow line that appears in his spectrographic photographs, and of a green line due to glowing nitrogen that can be caught just before dawn and just after evening twilight but not at midnight. This line seems to be identical with the most prominent band of wave-lengths in the light of the aurora.

Dr. Slipher made his studies with a specially built instrument that enabled him to obtain spectrum photographs of five parts of the sky at the same time: the four points of the compass and directly overhead. Comparing these simultaneous photographs, he discovered that the sky near the horizon gives off radiations rich in red and infra-red rays, while at the zenith these are relatively feebler, though the violet rays in the visible spectrum are as strong there as elsewhere in the sky. This effect Dr. Slipher attributed to the greater density of the atmosphere near the earth's surface, which selects out the rays of longer wave-length and partially blocks the violet and ultra-violet rays.

Dr. Slipher was called to England to receive a medal of the Royal Society just before his paper was to be read, so that the actual presentation of his paper was made by a colleague.

EFFECTS OF EARTHQUAKES ON WATERS OF THE EARTH

STRANGE tricks that earthquakes play with rivers, lakes and subterranean waters of the earth were described to the American Geophysical Union by Captain N. H. Heck, of the U. S. Coast and Geodetic Survey.

Earthquakes often cause fountains of water or liquid mud to spurt from the ground. They sometimes change the course of subterranean streams, or the quantity of water flowing in them. In the earthquake that occurred in New York State in 1929, the Attica reservoir filled, although there had been no rain, while in a region not far distant the wells went dry.

Earthquakes often cause strange behavior by rivers and other bodies of surface water. The famous New Madrid quake in the lower Mississippi Valley over a century ago caused the great stream to flow backwards for a time, and the disturbance was followed by the formation of several entirely new lakes that are still in existence. Earthquakes may dam up streams to form lakes, or they may break down natural dams and release floods or mud flows. Some of the most disastrous effects of recent earthquakes in interior China were due to the jarring loose of masses of watersoaked fine earth, causing terrific landslides.

Water, in its turn, has effects on earthquakes. Some of the strangest, and to scientists the most puzzling, of earthquake phenomena are the so-called gravity waves of earthquakes, waves that travel visibly along the surface at express-train speeds, though they are very much slower at that than the waves that are felt but are too swift to be seen. These gravity waves are much affected in their intensity and velocity by the amount of water held by the soil through which they move. Captain Heck recommended a thorough study of the rate of wave travel through water-soaked earth as a problem promising both theoretical and practical results in the science of earthquakes.

THE EARTH'S CORONA

THE earth, like the sun, has a corona—a luminous gaseous envelope extending far out into space. Its existence has been demonstrated by studies of the aurora borealis, or northern lights, Professor Lars Vegard, of the University of Oslo, Norway, told the American Meteorological Society at its meeting in Washington.

The earth's corona, however, shows some marked differences from the sun's. The sun's corona, so far as we know, is generated by the sun's own power; the earth's is a product of the action of the sun on gases in the earth's outer atmosphere. Furthermore, the earth's corona is decidedly eccentric, being far more extensive on the side of the earth nearest the sun than it is anywhere else.

Auroral displays have been measured at heights of from 70 to 700 or 800 kilometers (43 to 490 or 550 miles) above the surface of the earth. Spectroscopic studies of their light indicate that the glow is due mostly to electrically excited nitrogen gas, which apparently exists at considerable density even at those great heights.

"To explain this fact," the speaker continued, "we assume that in the auroral region the atmospheric matter is brought to high altitudes through the effect of electrical forces, which result from the photoelectric action of the sun's rays of short wave-length."

Singularly enough, there are no spectrographic lines indicating the presence of the light gases, helium and hydrogen, at these elevations; or at most they are exceedingly faint and feeble. This runs quite counter to the assumption often made that layers of these "balloon gases" float on the top of the earth's atmosphere. On the contrary, all the gases in the atmosphere seem to be thoroughly mixed.

Auroral light comes from rather chilly sources, though they are not so intensely cold as we are sometimes prone to think everything must be in the upper air. By comparing their spectra with those of laboratory light sources at known temperatures, Professor Vegard reached the conclusion that auroral light centers are active at temperatures about 30 degrees below zero Centigrade, or 22 degrees below zero Fahrenheit.

HEAVY WATER

A BATTERY of electrolytic cells for the production of heavy water and hydrogen of mass 2 was announced to the American Philosophical Society by Professor Hugh S. Taylor and Henry Eyring, of Princeton University.

With this battery of 270 units each holding 200 cubic centimeters of potassium hydroxide solution it has been found possible in somewhat over seven days to concentrate by electrolysis the heavy hydrogen present in

twenty-five gallons of old alkali solutions which have been used for a period of years as a source of electrolytic hydrogen and oxygen. In this way the heavy hydrogen has been concentrated to yield about three quarters of a glassful of water containing 7 per cent. of the heavy hydrogen. A weekly production on this scale can now be maintained at Princeton.

The further enrichment of this water to yield the 100 per cent. pure heavy isotope of hydrogen of mass 2, or water of mass 1.1, is being effected by a combination of further electrolysis coupled with a new process of fractionation of the hydrogen isotopes from gas absorbed on gas-mask charcoal at the temperature of liquid air. It has recently been shown by Taylor, Gould and Bleakney that this method can secure a several fold enrichment of the hydrogen in a single operation.

The hydrogen of mass 2 produced at Princeton will be employed to trace the differences in speeds of reaction of the light and heavy isotopes at surfaces and with various gases. In this way fundamental advances in our knowledge of the speed of chemical processes are expected.

The water already attained represents a two thousandfold enrichment of the heavy water and it is calculated that 150 gallons of ordinary water must be decomposed to yield the residual ¾ glassful of water exhibited at Philadelphia.

CANCER HOUSE DISPROVED STATISTICALLY

Do "cancer houses" exist? "No!" is the emphatic answer of two French statisticians who have recently reported their investigations to the French Academy of Medicine. Their names are Auguste Lumière and Paul Vigne, and the town whose cancer death-rate they have investigated house by house is Lyon.

Here, in the course of 20 years, there were 6,703 deaths from cancer exclusive of those occurring in hospitals and nursing homes. The number of houses in Lyon was 23,258. Were the 6,703 deaths evenly distributed throughout these houses, or was their distribution so uneven that chance alone could not explain the frequency of cancer deaths in certain houses?

It was ascertained that there were as many as 18,231 houses in which there had been no death from cancer in the 20-year period. There were 3,869 in each of which there had been one cancer death, and 953 with two cancer deaths each. At the extreme end of this list were two houses in each of which there had been as many as 7 deaths, and one in which there had been 8 deaths.

Were these latter houses really cancer houses, possessing certain sinister properties responsible for these deaths? Or was the accumulation of cancer deaths just an accident? Finding a correct answer to these questions was not only of considerable academic and scientific interest, but also of some financial importance to the owners and tenants of the suspected houses.

As the number of persons living in each house was not available for statistical study, the answer to this question had to be sought indirectly by the following means: A study was made of the numbers of births, marriages and deaths from all causes in the same period and town. All three were found to be distributed throughout the houses of Lyon in the same apparently irregular manner as were the deaths from cancer.

Now, no one has yet had the Gilbertian fantasy to suggest the existence of birth or marriage houses endowed with peculiar properties which add to the fertility of nations or their matrimonial rates. And so long as cancer deaths are distributed throughout the houses of a community with the impartial irrelevance observed in the behavior of babies and brides and bridegrooms, no one need dread renting a house because it has a reputation for being a cancer house.

ITEMS

THE rate at which cosmic rays ionize, or electrically charge, molecules of three atmospheric gases has been determined by Dr. W. F. G. Swann, of the Bartol Research Foundation. Dr. Swann reported on his researches before the meeting of the American Philosophical Society. Dr. Swann arranged two cylinders, which could be filled with gas at a pressure of seven atmospheres, or 105 pounds per square inch. Electrical connections were arranged so that the "kick" of each molecule as it received a charge from a cosmic ray would be registered. Per centimeter (0.39 inch), the rays charged 145 molecules of oxygen, 150 of nitrogen and 200 of argon.

LIQUID helium and superconducting lead were produced at the new cryogenic laboratory of the California Institute of Technology just six months after the beginning of construction and a year after the project was started. Professor A. Goetz found that a thirty-foot coil of fine lead wire suddenly lost all trace of electrical resistance because of its immersion in liquid helium. It remained in this superconducting state for twenty minutes while he and Dr. Alfred B. Focke, research fellow, congratulated each other that the apparatus functioned perfectly as designed and needs no modification. Last December liquid hydrogen was produced as the new laboratory's first step toward liquid helium. Helium liquefies at 450 degrees Fahrenheit below zero.

SENDING up balloons and airplanes with observers and instruments to ask why the stratosphere over the equator lets out less of the earth's heat than escapes through the atmospheric envelope in the polar regions was advocated at the meeting of the American Geophysical Union in Washington, by W. J. Humphreys, of the U. S. Weather Bureau. He called attention to the anomaly that the earth loses less heat to outer space over the tropics than it does over the polar areas; less also from rainy areas than from those of prevailingly fair weather. Why this should be the case nobody knows as yet, and this gap in our scientific knowledge Professor Humphreys presented as a challenge to researchers in meteorology. He also proposed barometric measurements from high mountain tops to determine whether the temperature of the atmosphere as a whole varies with differences in solar radiation. An increase by as much as three degrees Centigrade, he said, would cause a 2.5-millimeter increase in the barometer reading.

SCIENCE NEWS

Science Service, Washington, D. C.

TOXIN TREATMENT IN THE PREVENTION OF PNEUMONIA

PNEUMONIA attacks may be warded off by hypodermic injections of the poison produced by the pneumonia germ, it appears from studies by Dr. Arthur F. Coca, professor of immunology at the Cornell University Medical College. He reported his investigations of this germ to the American Association of Immunologists meeting this week in Washington.

"The pneumococcus produces a substance which is highly poisonous for human beings but much less so for lower animals," he explained. Apparently this toxin may be the important injurious agent of the pneumococcus, in which case Dr. Coca's experiments indicate that it will be easy to give people resistance or immunity to pneumonia as is now done for smallpox, typhoid fever and diphtheria. When this poison or toxin is injected into human beings, an antitoxin is formed in the blood which enables the individual to resist the toxin, giving him what physicians call immunity to it. Two injections of toxin produced immunity in two thirds of the susceptible children within three weeks. Skin tests of patients who were recovering from pneumonia showed that their blood serum has been found to neutralize the toxin.

NEW DISEASE CAUSED BY A YEAST-LIKE ORGANISM

A CASE of a new and unique disease, caused by a yeast-like organism, was reported by Drs. G. H. Hansmann and J. R. Schenken, of Iowa City, at the opening session on May 9 of the Washington meeting of the American Association of Pathologists and Bacteriologists. The patient was a white man, forty-three years old at the time of his death, according to the doctor's records. For the last sixteen years of his life he had suffered from a refractory skin ailment. This first appeared on the skin back of his knees in 1916. By 1929 the entire skin was involved. The ailment consisted of a scaly inflammation, underneath which the skin was somewhat thickened and reddened. During 1929 the skin became more reddened and thickened and cracked easily. In June of 1932 hard elevated spots, something like pimples, appeared. Late in July the patient developed a high fever with signs of pleurisy, and died on August 7.

Examination of one of the elevated spots from the skin and one of the lymph nodes, which had become enlarged, showed that both contained a small organism which appeared as a small yeast. This same organism was also found in the lungs and adrenal glands. Guinea-pigs, rabbits, rats and dogs develop the same sort of skin disease when infected with this organism. The yeast-like organism causing the disease is smaller than any heretofore described and probably belongs in the Oidium group. The character and distribution of the lesions in man are unlike any other disease.

THE CAUSE OF ARTHRITIS

A CERTAIN type of arthritis, known to physicians as hypertrophic or degenerative arthritis, results from the "wear and tear" of increasing age and from repeated injury to the joints, Drs. Granville A. Bennett and Walter Bauer, of Harvard Medical School, reported at the medical meetings held this week in Washington.

These investigators do not agree that the condition is the result of some inflammatory process. They even found marked changes in the joints, indistinguishable from those of hypertrophic arthritis, in individuals who do not have important symptoms of joint disease. The word arthritis, they pointed out, is probably not the correct one to use for this particular condition, if, as their investigations show, it is nothing more than the degenerative joint changes due to the wear and tear of increasing age. Earlier studies had shown quite clearly that the cartilage of joints has a very feeble, limited ability to regenerate or renew itself. Repeated injury to displaced knee joints did result in certain animals in very marked changes like those seen in human hypertrophic arthritis.

Because of these findings, it was decided to see what changes might take place in human joints subjected to unusual use or repeated injury. For the first part of the problem they studied a single joint which had been subjected to repeated injury or constant use, comparing it with the opposite joint which had not had such use or injury. They found that such injury or constant use was in itself enough cause for marked degenerative changes of the joint.

In a second investigation, they collected and examined, with x-ray and microscope, human knee joints representing various ages from the first to the ninth decade of life. The owners of these joints had never, so far as could be determined, had symptoms of joint disease. With each succeeding decade in life beyond the second, that is, after age twenty, increasing degenerative changes in the joint were seen. The changes were identical to those commonly considered characteristic of degenerative or hypertrophic arthritis.

Finally, the studies showed that arteriosclerosis, popularly known as hardening of the arteries, was not an important factor as the cause of this disease.

CHRONIC ARTHRITIS

A CHEERFUL, optimistic temperament is a great asset for the patient fighting rheumatoid arthritis, Dr. Russell L. Cecil, of New York City, said in a discussion of the prognosis in chronic arthritis at the Washington meeting of the American Clinical and Climatological Association. The prospects of recovery from chronic arthritis, sometimes popularly known as rheumatism, depend primarily on the type of arthritis from which the patient is suffering.

In the case of osteo-arthritis, the characteristic de-

generative changes are permanent and tend to progress slowly. The symptoms resulting from these changes, however, can usually be ameliorated or entirely cleared up by proper treatment. The chances for recovery from rheumatoid arthritis are hard to determine since there are no adequate statistics as to the percentage of permanent recoveries. "The disease never menaces life," Dr. Cecil stated, "but the danger of serious deformity and crippling always exists, especially in neglected cases."

It is in this type of arthritis that the cheerful, optimistic temperament was said to be a great asset. Young people respond to treatment better than elderly patients. Those who have an acute onset seem to have a better chance than those whose symptoms come on insidiously. Much depends on the joints involved, the knees, hips and back offering the greatest difficulty. Finally, the ability and the disposition of the patient to devote himself zealously to the régime and treatment prescribed by his physician is of the greatest importance in forecasting the chances of recovery.

CANCER CELLS

THE size of the cell nucleolus is the distinguishing feature by which a cancer cell may be told from normal cells, according to a report by Drs. William Carpenter MacCarty and Eva Haumeder, of the Mayo Clinic, before the American Association for Cancer Research. A method of distinguishing between normal and cancer cells has long been sought. It is not always possible to tell from its gross appearance whether or not a tumor is malignant.

Surgeons about to remove a tumor generally send a small piece of it down to the hospital laboratory for diagnosis. The pathologist must, within two or three minutes, cut a paper-thin sliver from the piece of tumor tissue, fix it on a glass slide, stain it, examine it under the microscope, and report to the surgical team waiting in the operating room whether or not the tissue is cancerous. But even when examined in this way, cancer cells sometimes look so much like certain types of normal, non-malignant cells that it is extremely difficult to make an accurate diagnosis.

Drs. MacCarty and Haumeder have found that the area of the nucleolus in the cancer cell is much greater than the area of normal cell nucleoli. They conclude that the cancer cell has at least one differential characteristic and that this must be used by those who expect to reduce the mortality from cancer. The nucleolus is a very small but important part of a cell. For their investigations, a special method of measuring this small area was devised.

THE PIGMENTED HAIRY MOLE

THE pigmented, hairy mole appears to be a link in the evolutionary chain between the hairy touch organs of man and other mammals and the colored touch organs of the amphibian-reptilian type of animal, such as the water-snake. In other words, the mole on your neck is closely related to the dark-colored bumps on snake skin. This evolutionary theory was presented by Drs. George F. Laidlaw and Margaret R. Murray, of Columbia University, at the Washington meeting of the American Association of Pathologists and Bacteriologists.

The pattern and structure of these moles does not resemble anything known in normal skin of mammals and it is a faithful reproduction of the colored, elevated and innervated spots of the amphibia and reptiles. In the course of evolution, these colored tactile spots of the snakes and amphibia were replaced in mammals by hair follicles and by mammalian touch cells. In its hair follicle, the mole is mammalian, but in its coloring, elevation and the arrangement of cells and nerves, it is reptilian.

The evolutionary theory explains many obscure points about moles, Dr. Laidlaw said. For instance, it explains why pigmented moles are rare in hairy mammals, such as cats and dogs. Their skin has specialized far beyond human skin in the production of hair. In its relative absence of hair, human skin is closer to the ancestral snake skin, and consequently, as in its pigmented moles, it bears more vestiges of former reptilian life spent half in water and half in air. "Port wine" marks may be explained as vestiges of the tangle of veins of an amphibian skin, dating from the stage when man's ancestors breathed through their skins.

INHERITED RESISTANCE TO INFECTIOUS DISEASES

STUDIES with mice at the Rockefeller Institute, New York, show that resistance to disease is a hereditary trait like color of eyes, hair or skin. Strains of mice highly susceptible to or highly resistant to a given disease may be segregated by selective breeding, Dr. Leslie T. Webster reported at the Washington meeting of the American Association of Pathologists and Bacteriologists.

Starting with a strain of mice 37 per cent. susceptible to mouse typhoid, he selected lines 85 per cent. and 15 per cent. susceptible, respectively. The 85 per cent. susceptible lines were descendants of mice highly susceptible to mouse typhoid, while the 15 per cent. susceptible descended from relatively resistant mice. Resistance factors are dominant, and not sex-linked, Dr. Webster found.

Mice from strains resistant to disease were heavier but not more fertile than the susceptible mice. The tissues throughout the bodies of these resistant mice seemed less sensitive to the organism causing mice typhoid than did the body tissues of susceptible mice. This suggested to Dr. Webster that the hereditary factors giving resistance to disease exercise general rather than local influence in the animal body. These hereditary factors concerned with resistance or susceptibility to disease can operate against a number of but not necessarily all harmful agents. So that an animal, possibly a man or woman, may be born with ability to resist attacks of a number of diseases, but still may be susceptible to a few infectious diseases.

THE INVASION OF THE BODY BY DISEASE GERMS

THE extent to which disease germs can invade the body depends on the amount of inflammation they cause at the

site of their entry, it appears from investigations reported by Dr. Valy Menkin, of Harvard University Medical School, to the American Association of Pathologists and Bacteriologists. By injecting a dye into the body at a place where bacteria had previously been injected, Dr. Menkin found that staphylococci, the organisms that are found in boils, limit the extent of their invasion to a very small area. They do this by causing a rapid inflammation which results in mechanical obstruction of the draining lymphatics, the avenues by which the disease germs, or other foreign matter, might continue their invasion of the body.

The pneumococcus and the fearsome streptococcus, on the other hand, do not cause such rapid obstruction of these avenues. In the case of the streptococcus, Dr. Menkin found the avenues are open for as long as two days. This gives the disease germs a chance to get far in their invasion of the body and probably accounts for the serious effects on the whole system of infection with these organisms. Dr. Menkin was able to determine the speed with which the germs could invade the body by watching the rate of progress of the dye which invaded the body just after the organisms had been introduced. When the dye could not proceed any farther, he concluded that sufficient inflammation had occurred to obstruct the path for the organisms also.

ITEMS

DISCOVERY of bacteria belonging to the Brucella group, which cause undulant fever, in diseased vertebrae of swine was reported by Drs. William H. Feldman and Carl Olson, Jr., of the Mayo Clinic, at the Washington meeting of the American Association of Pathologists and Bacteriologists. The animals did not show any signs of disease at the time of slaughter and the organs were healthy-looking. This discovery gives further evidence that swine are a dangerous source of undulant fever infection for farmers, packing house employees, retail butchers, housewives and others who handle uncooked pork.

WHEN the moon partly entered the earth's shadow last September, as seen from Europe, the shaded part reflected less than a thousandth as much violet light as the ordinary full moon, but it sent back to us about one six hundredth as much infra-red light as the uneclipsed portion. This was determined by photographs taken by Dr. R. L. Waterfield, and just announced to the British Astronomical Association. The earth's atmosphere bends some of the sun's light around into its shadow, and for that reason the shadow, when it falls on the moon and produces a lunar eclipse, is not entirely dark. Because the longer waves of the red and infra-red light pass through the earth's atmosphere more readily than the shorter blue and violet waves, the eclipsed moon usually has a ruddy color. Dr. Waterfield's data show how much of this light is so refracted into the shadow.

AN ingenious robot detective that will "frisk" a man for concealed weapons, register the fact that it has found him and takes his photograph, all without his knowledge, was recently described in an address by O. H. Caldwell, editor of *Electronics*. The device is built around an electron tube. It can be so delicately adjusted that while it will react to a mass of metal as large as a revolver, it will ignore smaller metallic objects which law-abiding men usually have about them, such as watches, coins and bunches of keys. Another device described by Mr. Caldwell counts persons passing through an entrance, no matter how fast they come or how much massed in groups. It does not overlook odd sizes and shapes: when Mr. Caldwell tried to fool it by hiding behind an umbrella as he passed it, he got counted anyway.

THE cyanide bath now widely used for copper plating of steel can be replaced by a new non-poisonous electroplating solution developed by Dr. Colin G. Fink and Chaak Y. Wong, of Columbia University, and reported to the Electrochemical Society meeting in Montreal. A complex copper salt, chemically known as disodium diaquodioxalatocupriate, is used in the new bath, along with sodium sulphate and boric acid. The new method will be available for use in large automatic plating installations where strip steel, standard steel parts, etc., are coated with copper as the first step to other coating. A satisfactory copper deposit is obtained in only one minute with a low electrical current density with the new "oxalato" bath.

MORE progress has been made in the manufacture of lubricating oils during the past few years than in the preceding thirty, Dr. Gustav Egloff, petroleum chemist, stated in an address before the Society of Chemical Industry in New York on May 12. This progress has been brought about by the requirements of the high-pressure motors needed by high-speed airplanes, automobiles and motor boats. New extreme-pressure lubricants have been developed, made up of blends of petroleum oils, vegetable or animal oils and sulphur. Crude oils for lubricants are carefully selected and improvements in the refining process have been made for this particular demand.

A KATYDID'S knees, which are that creature's own peculiar "ears," have given men the novel experience of listening in on that insect's world of sound. The story of how scientists have tapped the hearing circuit of katydids and crickets by placing electrodes against the knees of the insects, amplifying the responses picked up, and listening in on these in an ordinary telephone receiver, was related to the meeting of the New York Branch of the American Psychological Association by Drs. E. G. Wever and C. W. Bray, of Princeton University. The resulting sound was always a sort of "shushing" noise, regardless of the source of the sound. Human speech lost all characteristic qualities except the rhythm, which was preserved. But the katydid is apparently deaf to the ordinary sounds of our world and hears principally those that are beyond the reach of human ears. Sounds of frequency below 800 cycles produced no response even when very loud. But the higher frequencies, even up to 45,000 cycles per second, were picked up. The limit of man's hearing is usually about 20,000 cycles—the shrillest note of the peanut whistle.

SCIENCE NEWS

Science Service, Washington, D. C.

NEW HORMONES FROM THE PITUITARY GLAND

NEW hormones from the pituitary gland, some just discovered and others not yet found but predicted, were described at the Congress of American Physicians and Surgeons at the recent Washington meeting.

One of these new hormones is an entirely new substance, different from any other obtained from the pituitary gland, according to an announcement made by Dr. Herbert M. Evans, who is working at the Rockefeller Institute, New York City. This substance greatly increases the effect of one of the female sex hormones and apparently has a sex-stimulating effect of its own. But it is so new that Dr. Evans was not yet ready to discuss its significance. Another new pituitary hormone apparently presides over the vitally important cortex of the adrenal glands.

When the pituitary, by a very delicate operation, is removed from its protected location in the center of the head, the cortex of the adrenal gland wastes away. Without this part of the adrenal gland, or the hormone it produces, cortin, life can not go on. A certain extract of the pituitary gland, however, restores to normal the adrenal cortex that had wasted away upon removal of the pituitary gland.

Dr. Evans stated that if the research of the next few months shows this pituitary extract to be distinct from all the other pituitary hormones, it will be the new adrenalotropic hormone of the pituitary. The relation of this pituitary-adrenal situation to the adrenal cortical hormone essential for life is not yet clear.

Another dramatic development of the anterior pituitary story is the relation between this gland and the body's use of sugar. Dr. B. A. Houssay, of Buenos Aires, showed that the death which usually occurs soon after the pancreas is removed either can be prevented or averted for a long time if the pituitary gland is removed at the same time as the pancreas. The latter organ is the one that contains the insulin-producing islands of Langerhans. When this organ does not produce enough insulin, diabetes follows.

Now Dr. Evans and his associates at the University of California have found that a true diabetes can be produced in dogs merely by giving them a certain extract of the pituitary gland. This together with the work of Houssay and other investigators seems to establish the fact that there is a relation between the pituitary gland and the body's use of sugar. Dr. Evans and associates are now at work on the task of distinguishing this possible new hormone, the diabetogenic hormone, from the others of the pituitary gland.

The tendency toward the coinage of new pituitary hormones is being vigorously resisted by Dr. Evans and by other scientific workers. It would have been preferable, he said, to have considered many of the effects he described as shared by the two or three hormones now so well established as coming from this portion of the pituitary gland. At the present time four substances can be considered as separate hormones endowed with specific effects. These are the growth hormone, the gonadotropic or sex hormone, the lactogenic hormone and the thyreotropic hormone which has recently been shown to have a profound influence on the thyroid gland.

The chemistry of these pituitary hormones was discussed by Dr. J. B. Collip, of McGill University. Their application in the treatment of disease in women was discussed by Dr. Emil Novak, of the Johns Hopkins Medical School.

ONE-CELLED ANIMALS GROWN ON AN INORGANIC DIET

ANIMALS feeding and growing new generations of themselves, on a wholly inorganic diet of a type hitherto considered suitable only for plants equipped with the green synthesizing pigment chlorophyll, have been reared in the zoological laboratory of the Johns Hopkins University by Professor S. O. Mast and Dr. D. M. Pace.

The animals were the one-celled primitive species known as *Chilomonas paramecium*. They were "planted" in a sterile culture medium containing sodium acetate, ammonium chloride, magnesium sulphate and potassium phosphate. Under normal conditions the animals reproduce rapidly by division into two parts, and they usually contain relatively large quantities of starch and fat. In the culture solution they gave rise to 3.4 new generations a day. When sodium silicate was added their reproduction rate went up to 3.9 generations a day.

When the solution was made up minus the organic salt, sodium acetate, the reproduction rate went on at the same level for three or four days, but then the animals died. But in the same totally inorganic solution with a heavy increase in carbon dioxide in the air over it—20 per cent. instead of the normal .3 per cent.—growth and reproduction went on indefinitely and specimens produced were well filled with starch and fat.

A hint of the cause of death when both the acetate and the carbon dioxide were low is contained in the fact that under these conditions the individual animals are very small, containing little starch and fat. Death under these conditions is therefore probably due to starvation.

For some unknown reason, the silicate salt seems to be necessary in the all-inorganic culture solution. If it is omitted, the animal divides a few times and then dies. Silicon is not usually an indispensable element to either plants or animals. The Johns Hopkins investigators suggest that in this case it probably acts as a catalyst, that is, as an agent for producing chemical transformations without itself taking part in them.

The results obtained, they state in conclusion, indicate that only eight chemical elements are necessary: nitrogen, carbon, hydrogen, oxygen, potassium, magnesium, phosphorus and sulphur. But they hold that traces of a number of other elements are probably also necessary.

THE PRODUCTION OF HELIUM

CHEMICAL evidence of the production of helium gas from paraffin and similar carbon-hydrogen compounds, by bombardment with the mixed radiation from thorium is adduced by Professor Fritz Paneth and his associate, Dr. P. L. Günther, of the University of Königsberg, and reported in a letter to *Nature*. The rays given off by thorium B and thorium C themselves contain some helium in the form of alpha particles, but after passing through paraffin, there is a surplus of helium amounting sometimes to 1000 per cent.

Helium is one of the "rare" gases, although it is now used to fill airships. It is at present obtained mostly from natural gas in America, which country has practically a monopoly on its production.

A practical method for the manufacture of helium would be of great commercial value, but the method described by Professor Paneth and his associate can not as yet be used for this purpose. The amounts they obtained were very small and were detected only by improved methods of analysis.

Nevertheless, their experiments are extremely important because this is the first indication that the transmutation of elements may be effected in amounts large enough to be chemically detectable. Until now, proofs of artificial transmutation depended upon the physical detection of single atomic destructions, observed as scintillations, or by electrical methods. Only when the new atoms formed were expelled with a large amount of energy could the transmutation be detected by these physical methods.

SOUND WAVES AND MOLECULES

RECENT investigations carried out in the University of California at Los Angeles suggest that the excessive absorption of sound in air of certain humidities is due to collisions between oxygen and water molecules. Professor Vern O. Knudsen described, at the recent meeting of the Acoustical Society of America, the Los Angeles experiments, in which Dr. H. O. Kneser, visiting physicist from the University of Marburg, cooperated.

Sound travels freely through chemically dried air, particularly at low temperatures, according to the electrical recording instruments of the California laboratory. Perhaps this accounts for the common opinion that audibility is keen on a clear, cold night. The introduction of small quantities of moisture promptly damps off the sound, especially tones of high pitch. Peculiarly, this phenomenon does not occur when pure nitrogen is substituted for the air, in spite of the fact that air is nearly 80 per cent. nitrogen. A shift to pure oxygen in the experiment reveals this latter gas as the guilty party. But oxygen alone is rather ineffective. Water vapor must also be present to affect the sound waves.

Drs. Knudsen and Kneser find their experimental records in agreement with the theory that the water molecules catalyze, or inspire oxygen molecules to pick up sound waves, convert them into heat or other motion, and thus destroy the sound. The extent to which all this occurs varies greatly with the frequency or pitch of the sound. Peculiar results may thus turn up. For example, the consonants in spoken words, which in general are of high frequency, are damped off more than the vowels of low pitch. Or in the symphony orchestra concert, if the humidity is at a certain value—not too high or too low—the message from the piccolo gets lost before it gets to the rear of the hall. Thus arises one more good argument for the new art of air-conditioning in public buildings.

More important, possibly, than the acoustic applications lies the possibility of interpreting molecular chemical reactions from the behavior of sound waves. Heretofore the vibrational responses of atoms have been supposed to require the enormous frequency values of light—whence the modern science of spectroscopy. Now it appears that even sound waves, counting but a few score or a few hundred per second, have a definite relation to intra-molecular forces. Preliminary experiments by Dr. Knudsen on ammonia, hydrogen sulfide and other gases show decided variations in behavior of the different chemical species. Thus we have a new mode of attack on the age-old mystery of molecular composition and the behavior of objects too small to be seen individually.

THE WINTER WHEAT CROP

WINTER wheat in the United States will be a short crop this year, according to the U. S. Crop Report for May. The estimated yield will be 337,485,000 bushels, as compared with 464,151,000 bushels in 1932, and a yearly average of 539,436,000 for the five-year period 1926–1930. This represents a decrease of 27 per cent. from the 1932 figure, and of 43 per cent. from the five-year average.

This is due partly to a decrease in total acreage and partly to a decline in yield per acre. This year's crop will come from 27,096,000 acres, as compared with 33,656,000 acres in 1932 and 28,560,000 acres for the 1926–1930 period. The yield per acre is expected to be 12.5 bushels, as against 13.7 for 1932 and 14.7 for the five-year average.

Figures for spring wheat are still fragmentary, because the wet spring has interfered with sowing. The spring wheat crop may also be below average in both acreage and per-acre yield. Foreign winter wheat acreage in 24 northern hemisphere countries is reported as slightly below last year's sowings, though a little above the 1931 figures. However, inasmuch as Russian wheat plantings are still largely an uncertain quantity, nothing very definite can be forecast about foreign wheat production.

The Food Research Institute at Stanford University has been conducting a survey of the wheat situation, and has a report in preparation which will be issued within a few days.

GORILLA WITH AN EXCEPTIONAL BRAIN

WHAT appears to be in many respects the "best" animal brain ever studied has recently been given an exhaustive examination by Dr. C. J. Connolly, of the department of psychology of the Catholic University of

America. His report was made to the Smithsonian Institution.

The brain studied by Dr. Connolly is that of a three-year-old mountain gorilla, which died in the National Zoological Park a few months ago. It was turned over to Dr. Connolly because he has made a specialty of comparative cerebral anatomy.

The brain of this little gorilla, which weighed only forty pounds at his prime, was larger than the brains of many adult gorillas which have been studied, and indeed is one of the largest great-ape brains on record, in spite of its late owner's extreme youth. It is the first brain of a mountain gorilla studied in detail; all other gorilla brains which have been examined were those of the coast gorilla subspecies.

The brain weighed 466.6 grams, a little over a pound. The average weight of the brains of six adult female coast gorillas reported by Dr. Connolly was 379.3 grams, about three quarters of a pound. The average brain weight of three young male coast gorillas, comparable in age, was only 318.3 grams.

If the gorilla's brain grows at the same rate as that of a human being, this baby mountain gorilla, had he lived, would eventually have had a brain weighing more than 600 grams. The lightest normal human brain weighs about 1,100 grams. If the assumption of an eventual 600-gram adult brain-weight for the male mountain gorilla is correct, this represents substantially more than half the human brain-weight; and hitherto apes have been allowed less than half. The mountain gorilla may therefore set a new record for animal brains.

However, Dr. Connolly points out that this estimate may be upset by other factors; it is even possible, he says, that the little three-year-old gorilla may have had as heavy a brain as he would ever have possessed had he lived to full growth.

The brain is described as "typically anthropoid." The cerebellum, which is concerned with balance and muscular coordination in general, is relatively massive, as in all ape brains. The cerebrum, where the higher sense organs have their centers, and which seems to be the seat of consciousness and thinking, has a relatively high development, distinctly in advance of the coast gorilla brains examined. Dr. Connolly found a rich pattern of convolutions, especially in the frontal lobe, which some authorities believe most closely associated with intelligence.

In spite of his seemingly exceptional brain, however, the gorilla was in life no ape genius. His movements were deliberate, and even clumsy. He always seemed, said Director William Mann, of the National Zoological Park, "just a normal gorilla."

ITEMS

IF we could see the earth from a distance out in the heavens it would appear as a bluish planet, Professor V. M. Slipher, of Lowell Observatory, Flagstaff, Arizona, stated in the George Darwin lecture delivered in London before the Royal Astronomical Society. The gold medal of this leading astronomical organization was presented to Professor Slipher in the presence of a distinguished scientific audience that included Dr. Willem de Sitter, Sir Arthur Eddington and Sir James Jeans. Professor F. J. M. Stratton, president, made the presentation. The blueness of the earth was determined by Professor Slipher from spectrograms made photographically of the earthshine on the moon. Light from the earth was reflected by the moon back to Professor Slipher's delicate instruments. Pluto, the most recent of the planets to be discovered, which was found at Lowell Observatory, is a reddish planet which is brighter to the eye than it is on a photographic plate.

COSMIC rays smash into the atmosphere of Mexico City with more intensity from the west than from the east, Dr. Thomas H. Johnson, of the Bartol Research Foundation, has found in the course of an expedition arranged with the cooperation of the Carnegie Institution of Washington. His experimental results presented to the American Physical Society on Dr. Johnson's behalf by Dr. W. F. G. Swann, director of the Bartol Research Foundation, uphold the idea that cosmic rays are composed principally of positively charged corpuscles or particles. With three cosmic ray counters arranged in line so that a record was made only when all three were coincidentally discharged by cosmic radiation, Dr. Johnson pointed his instrument at various elevations. Comparing the intensities of cosmic radiation on the east and west sides of the magnetic meridian of Mexico City, percentage differences were found between east and west ranging from 1 per cent. at 25 degrees distance from the zenith to 25 per cent. at 65 degrees distance to the zenith. "These results are just those to be expected on the basis of the theory of the latitude variations of Lemaitre and Vallarta," Dr. Swann explained, "and they show that the principal corpuscular component of the primary cosmic radiation is positively charged."

COAL is now being mined with a saw instead of being broken loose with explosives. The development of the coal saw to its present highly practical state has improved quality and value of coal, according to C. D. McLaughlin, superintendent of the Pioneer Coal Company, speaking before the American Mining Congress. It has also improved working conditions and safety in mines without any change in organization and supervision, and without displacement of labor. Large lump coal that stands handling and transportation well results from saw mining.

PIGMY chimpanzees, constituting an animal race entirely new to science, were described before the meeting of the American Society of Mammalogists by Harold J. Coolidge, Jr., of the Museum of Comparative Anatomy, Harvard University. The species, known zoologically as *Pan paniscus*, is found south of the Congo River in Africa. It is the smallest chimpanzee in the world, and is characterized by small teeth, close-set eyes, small, almost covered ears and narrow back and shoulders. The only specimen thus far brought to this country is in the American Museum of Natural History, New York City.

SCIENCE NEWS

Science Service, Washington, D. C.

PROFESSOR BOHR AT PASADENA

BY DR. R. M. LANGER
California Institute of Technology

PAIRS of electrons, one positive and one negative, are sometimes produced when gamma rays from the element thorium pass through matter. This was reported by Dr. Carl D. Anderson, of the California Institute of Technology, in a conference, as a support of Dr. R. A. Millikan's contention that cosmic rays are originally mostly photons, or "bits of light," like gamma rays. Dr. Anderson has observed that among the energetic cosmic ray electrons there are about as many positive as negative electrons, as if they were produced in pairs.

Dr. Niels Bohr, the great Danish physicist now in Pasadena, said that after listening to the evidence it was scarcely possible to doubt the reality of the positron. He is the particular authority for modern theoretical physicists, yet he gave them something of a shock when he said that although theory had predicted the positron few theoretical physicists would have dared emphasize that before experiment had brought it out. The basis for our belief in the positron is therefore almost entirely an experimental one.

Dr. Bohr, on May 18, began a series of lectures on the foundations of atomic mechanics. He began with a careful discussion of the famous uncertainty principle, which has in recent years received unhappy treatment. He explained how the act of observation disturbs an electron or atom so that we must remain uncertain as to what its behavior would have been had we not observed it. If we give up the idea of trying to find what it would have done we save ourselves a great deal of worry and see the problem more rationally. Paradoxes then all disappear and atomic mechanics can describe all phenomena, provided we do not inquire about the atomic constitution of our measuring apparatus. When, however, we examine too closely we get into trouble with relativity. Physicists are stumped at this point and need further experiments to help them out.

If you are in a hurry you can't be too particular about energy. This is a version of the so-called uncertainty principle, which Professor Niels Bohr, of the University of Copenhagen, is driving home to physicists at Pasadena. When one body shoots by another and transfers energy to it, one can not inquire too closely as to whether the principle of conservation of energy has been violated, because it takes time to measure energy exactly. This fact helps clarify certain difficulties which old-fashioned physicists worried about.

Professor Bohr's main purpose is to get investigators to stop worrying about questions which have no possible solution. In return for this sacrifice of vain curiosity, he points out that paradoxes which have been proposed by Einstein and others dissolve themselves.

The Danish scientist is a master of simplification, and presents in brief and elementary form proofs which others achieve only after complicated mathematical developments. He showed in a few lines how material particles scatter each other according to the same law as that deduced for light by Lord Rayleigh when he explained why the sky is blue. In the optical case the blue light is more easily scattered than the red. Blue photons are heavier, so that here is a case where heavier bodies are pushed aside more easily than light ones. The same curious fact is shown when neutrons scatter protons a million times more frequently than the much lighter electrons.

A STRATOSPHERE BALLOON ASCENT

WITH the goal of floating eleven or more miles above the earth, higher than man has ever gone before, a stratosphere balloon with airtight man-carrying gondola of special design will rise from Soldiers Field, Chicago, in late June or early July as a part of the science program of the Century of Progress international exhibition.

Within the seven-foot diameter ball hung from the 600,000 cubic foot balloon will be two men, one a pilot and the other a scientist.

Lieutenant-Commander T. G. W. Settle, Navy expert who is licensed and qualified to pilot every type of aircraft known, will be in charge of navigating the balloon to its great height and back to earth.

Professor Auguste Piccard, the Belgian physicist, whose ten-mile-high balloon ascensions in Europe now are world records will probably be the scientist. If Professor Piccard can not make the flight, Professor A. H. Compton, of the University of Chicago, will designate one of his colleagues in cosmic ray research to take the stratosphere ride in the interest of science. Measurements of cosmic rays will be one of the main scientific objectives of the ascension.

A magnesium metal alloy, known as dowmetal, will be used in constructing the spherical gondola in which the men and scientific instruments will be housed during the flight. Dowmetal is a third lighter than aluminum. It is the metallurgical creation of the Dow Chemical Company of Michigan, who are now constructing the gondola. This saving in weight, coupled with a balloon that is a fifth larger than the one used by Professor Piccard on his previous flight, makes the exploration of the eleventh and even the twelfth miles above the earth extremely likely. The Piccard flights reached a little over ten miles altitude.

Tentative plans have been made to broadcast the flight, minute by minute, from the stratosphere to a ground radio station from which it would be relayed over one of the national radio chains.

The National Aeronautic Association has given its approval of the ascension and it will provide altitude instruments which will make the height records official for world record acceptance.

Near the top of the atmosphere in the stratosphere the balloon will hold 500,000 cubic feet of gas, which is

100,000 cubic feet more than the previous Piccard balloon. But at the start only about 125,000 cubic feet of very pure hydrogen gas will inflate the giant gas bag, which will have a pear shape due to its inflation to only about one fifth capacity. As the balloon rises, and most of the atmosphere and its pressure is left behind, the gas will expand tremendously and at the greatest height the balloon will be fully filled.

To obtain the greatest possible lift the Union Carbide and Chemical Company will furnish hydrogen gas of a purity of 99½ per cent. or better. Oxygen carried in tanks and released as needed within the gondola will allow the crew of two to live safely at stratosphere altitudes where there is practically no air. The balloon is being made by builders of the Navy's giant airships, the Goodyear Zeppelin Corporation at Akron, where Commander Settle is at present serving as airship inspector for the Navy.

The take-off will occur at ten or eleven o'clock in the evening, to take advantage of the cool night temperature during the early hours of the flight. As the sun rises the balloon will rise with it, ascending into thinner and thinner air as the heat of the sun expands the gas.

The greatest height above the earth should be reached about mid-afternoon when the sun is hottest. Then the descent will be made and the landing should be made in the evening about dark.

The great crowd of spectators which will throng famous Soldiers Field to watch the beginning of the flight will get a thrill as the balloon rises. A few hundred yards to the southeast of the starting point there are the 628-foot towers and cables of the Century of Progress skyride and the balloon will be shot up at about twenty miles per hour in order to clear this hazard with safety.

The exact day of the start will depend upon weather conditions. Where the balloon will land will depend on wind directions and other meteorological factors. Even if the magnesium metal sphere drops into one of the Great Lakes, it and its human and scientific freight will be rescued safely because the air-tight ball will float for hours.

HOW FILMS HOLD FAST TO METALS

BETTER protection for metal surfaces against rust and corrosion may be one of the practical results of an important discovery in pure science just reported to the Royal Society by two British physicists, Professor G. Finch and Dr. Quarrell, of the Imperial College, London.

Their discovery has to do with the way thin films of atoms or molecules arrange themselves when they are deposited on the surfaces of other metals by the special electrical method known as "sputtering." They found that the atoms in such films arranged themselves in the shapes of the metallic crystals underlying them, and not in the crystal shapes proper to their own natural makeup. Thus aluminum deposited on platinum assumed the dimensions of the platinum crystals so far as length and breadth were concerned, though the aggregations of atoms kept the greater height characteristic of aluminum. In this case the aluminum actually became denser than normal, because in two of its dimensions it had patterned itself upon the denser metal, platinum.

A deposit of zinc oxide upon zinc again crowded its crystals to fit them to the dimensions of the smaller zinc crystals. However, in this case the zinc oxide crystals grew taller than normal, so that their total volume remained unchanged.

The significance of the shaping of the deposited substance's crystals to fit the shapes of the underlying metal lies in the fact that there must exist between the crystals of the deposit and those of the substratum a special union or bond that will hold very firmly against any disruptive force. The deposited film is no mere loose layer laid over the surface, but is gripped hard by every atom in it.

The influence of the underlying metal extends for some little distance upwards. The crystal shapes of the underlying metal were preserved through a deposited layer as much as fifty atoms thick, their x-ray photographs showed. These studies of the physical properties of the films they have already deposited are being continued and new films are being made for further research.

ROBOT CLOCK ANNOUNCES TIME FROM THE PARIS OBSERVATORY

CALL an Odéon exchange telephone number in Paris at any hour of day or night. In clear, human tones the exact time, correct to a small fraction of a second, will be heard. Not a living operator but an automatic machine speaks. This speaking clock is set up at the Paris Observatory where time is determined by astronomical observations for the French nation.

At a recent meeting of the Société Astronomique de France, Dr. Ernest Esclangon, director of the Paris Observatory, described the device. The idea was first conceived, and preliminary experiments made, by M. Edouard Belin, pioneer inventor in the transmission of pictures by wire and radio. The final apparatus as now installed was made by the Maison Brillié, scientific instrument makers of Paris, under the supervision of their director, M. Mayer, and engineer, M. Nimier.

The speaking clock uses essentially the same methods that have made possible talking motion pictures, and the machine is driven by a synchronous electric motor, which is controlled by an accurate pendulum clock. In ordinary sound film a narrow strip along one edge carries the sound record, either in the form of a black line of varying width, or a series of cross lines of varying density. In both types, the light from an electric bulb shines through the sound track on to a photoelectric cell, which converts the variations in brightness, caused by the passing film, into a varying electric current. This current is amplified and operates the loud speakers.

In the Brillié machine, time speaking sound record is recorded on strips of paper, wound around an aluminum drum. Instead of having the light pass through the film, it is reflected from a small strip on its surface, into the photoelectric cell. As light or dark parts of the strip pass under the light, the reflected illumination varies, and the cell produces the necessary varying current. There are 90 strips of paper, 24 for the hours, 60 for the

minutes and 6 for the seconds. The drum, which is about a foot in diameter and two feet long, turns continually on a horizontal axis at the speed of one revolution in two seconds.

There are three reproducers, each consisting of the necessary electric lamp, lenses and photocell, which are carried along the drum. Each hour the one for announcing the hours shifts from one strip to the next; each minute the minute reproducer steps ahead and every ten seconds the reproducer for seconds makes progress. At midnight the first one goes back to start over again, at the end of each hour the minute reproducer returns, while the seconds one starts over at the beginning of each minute. Connections are automatically made so that the reproducers speak in the proper order, giving first the hour, then the minute and then the second, which is followed by a click marking the exact moment that has been announced. Announcements are given every ten seconds.

At the end of each minute, however, the announcement is different. Then it says "At the third click it will be exactly . . . such an hour . . . such a minute," then, at seconds 58, 59 and 60, there are clicks.

Though the machine is kept in motion continually, the exciting lamps, and the requisite amplifier tubes, are ordinarily turned off. When a telephone connection is put through to the clock at the observatory, relays operate to turn them on for an announcement. Thirty telephone lines to the clock allow that number of subscribers to call simultaneously.

The clock's announcement is also broadcast every morning at 8:30. Dr. Esclangon suggested that it might be well to devote a radio station especially to it, and let announcements of the time be given continually through the day and night.

THE ORIGIN OF PETROLEUM

PETROLEUM, now one of the principal wealths of the world, was originally garbage—offal from the endless complex banquet of the sea, that not even the bacteria in the bottom slime would eat.

This un-pretty picture of the origin of "black gold" comes from a report presented at the meeting of the American Petroleum Institute held at Tulsa, Oklahoma, by Dr. Parker D. Trask, of the U. S. Geological Survey. Dr. Trask and his associates have for a number of years been conducting an exhaustive study of both modern and ancient sea-bottom deposits, seeking for further knowledge of how petroleum was formed in the first place, so that seekers after oil may have a better idea of what kinds of geological formations are likely to yield paying results to their expensive drillings.

They found that fine-grained beds contain more organic matter than coarse-grained—clay more than silt, silt more than sand. They learned, as was to be expected, that where the sea bottom is rolling and irregular, richer deposits are to be found in the hollows than on the submarine hilltops or slopes. They found, above all, that the dead bodies of the myriad sea plants that escaped eating by fish and other marine animals were not left as raw materials for oil-making until even the bacteria of the bottom slime had taken from them such materials as they wanted for themselves.

This bottom bacterial action seems to be of the highest importance in the formation of the stuffs that eventually become petroleum. Crude plant materials, and such fishes and other animal carcasses as settle to the bottom, have relatively high nitrogenous and carbohydrate contents, which are unsuitable for working over into oil. The food requirements of the bacteria seem to be especially aimed at these non-oil-producing food materials, thereby leaving the organic débris in better condition for the oil-making processes themselves.

Oil-making seems to be an exceedingly slow job. It is not going on in the sediments now forming on the ocean bottom, but it is in progress in sediments laid down on the sea bottoms of geological yesterdays. The steps are not known with anything like satisfactory certainty, but there seems to be no doubt that great increase in sedimentary thickness, with resulting pressure and heat, squeeze and fry out the material that eventually becomes petroleum. It then seeps along migration paths through sandy strata, and collects in pools where impervious rock layers bar its further wanderings.

ITEMS

AFTER several months in which they have kept fairly far apart, Jupiter and Mars, the two bright planets that shine high in the evening southern sky, are approaching close together. Jupiter is the brightest object in the evening sky at present, with the exception of the moon, and Mars, reddish in color, is a short distance to the right. Now about five degrees apart, at the end of the month they will only be a degree from each other, and on June 4 they will be separated by a quarter of a degree, about half the moon's diameter. Mars will then be to the south of its larger neighbor. A few days previously, on June 1, the moon will pass close to both of the planets, making an interesting spectacle.

CORN planting has been so much delayed by the long period of wet weather over almost the entire eastern half of the country that the situation is now described as "critical" by the U. S. Weather Bureau. In the central Mississippi and Ohio valleys, much of the land has not even been plowed, let alone planted, and a great deal that has been prepared will have to be reworked because of its packed condition, the result of long-continued heavy rains. In Iowa, planting during the week continued slow or at a standstill. Other crops, especially spring wheat and oats, are also being held back in the soggy corn belt states. But more cheerful reports come from the drier lands to the northwest; offset again by stories of drought in the southwestern grain areas.

HIGH blood-pressure, known to physicians as hypertension, runs in families, it appears from a study of statistics reported by Dr. William Allan, of Charlotte, North Carolina, at the Congress of American Physicians and Surgeons meeting in Washington. In one series of cases, both parents of patients having high blood-pressure also suffered from the condition. In 349 out of 480 cases, one

of the patient's parents suffered from the same condition. In 121 families with both parents having high blood-pressure more than three fourths of the children suffered from it also. In 216 families with one parent having this condition, over two thirds of the children also had it. In 349 families, three fifths of the brothers and sisters of high blood-pressure patients were found also to have the condition.

DR. L. THATCHER has reported to the *Edinburgh Medical Journal* that a child of eighteen months was admitted to a hospital in Edinburgh, much under weight and unable to walk alone because of weakness. Doctors at the hospital diagnosed the ailment as a kidney inflammation. The child died. Then it was found that the child had received a daily dose of irradiated ergosterol equal to twice the recommended dose and that this severe dose was continued during the summer despite the fact that he was living an outdoor life at the seashore. The double dose of vitamin D resulted in calcium being deposited not only in the bones but in the kidneys. Death in this case was caused by too much vitamin D.

A GELATIN diet has given physicians new knowledge about a certain type of Bright's disease. Results of feeding gelatin to patients suffering from this condition were reported by Dr. G. Philip Grabfield, of Boston, to the American Society for Clinical Investigation. The gelatin diet was used because gelatin is one of the protein foods that does not contain sulfur. Dr. Grabfield was investigating the fact that patients suffering from this particular form of kidney disease tend to hold on to the sulfur in the diet even more than to the nitrogen. Patients who get swollen ankles and legs, known as edema, fail to excrete sulfur as well as nitrogen, while patients suffering from the same disease but without the swelling or edema fail to excrete nitrogen alone.

TEN minutes instead of ten days is the time required by a jeweler to regulate a watch to maximum time-keeping efficiency with the use of a new electric watch timer demonstrated to the Horological Institute. Accurate time intervals are given by a special electrical current of 100 cycles per second accurate to one part in ten million furnished by telephone companies from a constant frequency generator in New York. This current drives a synchronous motor similar to those that have come into such wide use in electric clocks. Within the new timer developed by the Bell Telephone Laboratories an image of the watch balance wheel is reflected on a mirror and a flashing lamp controlled by the precise synchronous motor flashes. This makes the watch's balance wheel seem to stand still when the watch and motor have exactly the same speed. The stroboscopic effect allows the jewelers to inspect and diagnose any trouble in a watch as well as regulate its rate of time-keeping quickly and accurately.

SCIENCE NEWS

Science Service, Washington, D. C.

SCIENCE AT THE CENTURY OF PROGRESS EXPOSITION

SCIENCE that has remade the world in the last hundred years is glorified at Chicago's Century of Progress exposition.

First of all, the very ground upon which the miles of buildings rest was created out of the shallow water of Lake Michigan by an engineering operation.

Then for the past three years engineers have been at work designing and rearing the buildings which are to serve for the next six months and then be demolished, much like the settings of a movie city. Yet while it lasts, the Century of Progress city will entertain millions of visitors and exhibit millions of dollars worth of displays and treasures. It will serve millions of meals. Adequate fire protection must be provided and hundreds of police, guides and other personnel will inhabit the exhibition city during the exhibition hours.

Some of the buildings strike new notes in modern architecture. The bright hues of many-colored paints are spread over the pylons, towers and walls, and unusual lighting effects blaze their contributions to the fair's decorative scheme at night.

Within the exhibition buildings and in outdoor exhibits, the imprint of science upon our everyday life is exemplified.

From the hemispherical planetarium at the northern corner to the gigantic transportation hall near the southern end of the exposition's expanse, there awaits the visitor a liberal education in science and its effects on human life.

The Hall of Science, to which the cross-bannered court of honor of the principal entrance leads directly, contains an array of mechanized, self-operating demonstrations and exhibits in chemistry, biology, physics, medicine and the earth sciences.

For nearly three years a corps of scientists has been at work designing, planning and building these exhibits, which are arranged in gaily painted booths upon wide aisles. In some cases the visitor or attendant pushes a button and the machine goes through its cycle of demonstrating a basic science principle. In other cases the exhibit methodically carries out its demonstration every few minutes without the prodding of button pushing.

Some of the machines talk their message by means of sound film or phonograph attachments, while others use more prosaic labels in ordinary or transparent lettering. Lantern slides automatically projected are parts of many demonstrations.

Giant electric machines, automatic telephones and switchboards and the thousands of devices developed by science and used in communication or the electrical arts are displayed in the great halls of communication and electricity. Here the large electrical manufacturers, the telephone and telegraph companies have their exhibits.

In the gold-domed Federal Building and the Hall of States with its emblematic façades, the federal and state governments show their public service and governmental activities, particularly along scientific lines.

The Adler Planetarium, as yet America's only mechanical show of the stars, is a part of the exhibition. In this richly somber dome the astronomical exhibits are contained.

America's agricultural interests are represented by a low, long building decorated in black, red and blue-green.

On Northerly Island, across the lagoon from the Hall of Science, is also the Hall of the Social Sciences, in which exhibits will recall the social consequences of the century of progress and suggest how the problems can be met.

Southward along the lake front, beyond concession buildings designed to amuse or convince the throngs commercially, is an area devoted to America's aborigines.

Rising to a commanding position is a reproduction of one of America's earliest and most striking architectural developments, a Maya temple. With strange carvings of huge mask heads, great serpents and other elaborate designs, painted brilliant yellow and green, there is duplicated a portion of the Munjas or Nunnery at Uxmal in Yucatan, built by the Maya Indians many years before Columbus discovered America. Within it can be seen some of the most valuable of the Maya treasures loaned by American museums.

In the shadow of the Maya temple five groups of American Indians will live primitive existences as their ancestors did before them. This will be their contribution to the Century of Progress. Nootka Indians from the American Northwest will raise their totem poles. Winnebagoes in wigwams will represent the woodland tribes. The plains Indians whose existence depended upon the buffalo will be represented by a group of Sioux Indians living in tipis, while the Pueblos will dwell in reproductions of their terraced villages, which were America's earliest apartment houses. Navahos, too, will show the part they played in the old Southwest. For the visitors these Indians will dance their ceremonials and sing their chants.

Close by the Indian villages and the Maya temple are the exhibition buildings of leading automobile manufacturers. Here may be seen the operating assembly line where complete cars are built from piles of parts.

The pageant of a century of transportation will be shown under the gigantic sky-hung dome of the travel and transport building, so large that railroad cars and transport airplanes seem lost beneath it. Antique vehicles used years ago will be contrasted with the most modern in transport. Along the lake front will be found famous ships of to-day and yesterday.

Enter the great central portion of the Hall of Science and a great globe will be slowly spinning before your eyes, while below there are samples and information on the ninety-three building blocks of the earth, arranged in the form of the chemist's periodic table.

These ninety-three chemical elements are the stuff from which all the rest of the fair's exhibits are made. They are the basic materials of the world and the universe. They have therefore been given a central position in the Century of Progress. Those who learned in school that there are 92 elements are informed that neuton is the one added to the periodic table in the last year.

Some of the samples in the display are rare specimens of chemical elements that were totally unknown a few years ago. Upon the model of the world above, there are shown the locations on the earth's surface where the elements are found most abundantly.

Man's highest into the stratosphere and lowest into the ocean's depths are represented by two historic spheres. One of these is the light aluminum gondola that Professor Auguste Piccard used in his world record balloon flights over Europe, while the other is the heavy steel ball in which Dr. William Beebe descended into the sea off the Bermuda coast for a world's record.

Atom smashing is symbolized by the original operating high voltage generator designed by Dr. Robert J. Van de Graaff, then of Princeton, and now of Massachusetts Institute of Technology. It is producing millions of volts for the enlightenment of the visitors.

A year's growth of a quarter-inch tree twig is visualized in 75 seconds by a 7¼ foot model in another corner of the hall. In a most realistic manner, the ingenious mechanical linden twig model adds wood on the inside of the growing zone and bark on its outside just as it does invisibly in the actual miniature twig.

A complete miniature oil refinery, all constructed in glass and actually making gasoline and lubricating oil, is seen in full operation in the central alcove.

From this main exhibition hall, the visitor can set out on exciting excursions into three floors of booths and displays dynamically telling the stories of physics, chemistry, biology, medicine and mathematics. To race through the exhibits would take three or four solid hours. If the visitor wishes to see each one operate and is determined to study each one quickly but understandingly, two or three days should be spent in the Hall of Science.

Nineteen of the world's greatest scientific men have their names emblazoned on the wall of the exhibition foyer of the Hall of Science.

The two Americans on this list of scientific immortals are Rowland and Michelson, both physicists. Professor H. A. Rowland was the famous physicist of the Johns Hopkins University who determined the mechanical equivalent of heat and made diffraction gratings for spectrum analysis known the world over. Professor Albert A. Michelson, of the University of Chicago, made the most accurate determinations of the velocity of light. He died in 1931.

Aristotle heads the list. Dr. Henry Crew, chief of division of basic sciences of the Century of Progress, who directed the extensive science displays and selected the list, explained that it was not intended to pick a science honor roll with which all would agree. He will agree with any who comment that there are famous names omitted.

The list of scientists and the fields of their researches is as follows: Aristotle—Biology, Archimedes—Mathematics, Euclid—Mathematics, Hipparchus—Astronomy, Leonardo—Anatomy, Galileo—Physics, Huygens—Astronomy, Harvey—Physiology, Newton—Mathematics, Lavoisier—Chemistry, Dalton—Chemistry, Darwin—Biology, Pasteur—Medicine, Faraday—Physics, Helmholtz—Physics, Maxwell—Physics, Mendelejeff—Chemistry, Rowland—Physics, Michelson—Physics.

The history of science has been written in 151 words of lyric prose and lettered upon the wall of the principal exhibition room.

The text, written by Dr. Henry Crew, formerly professor of physics at Northwestern University and now head of the division of basic sciences of the Century of Progress, is as follows:

Pythagoras named the cosmos; Euclid shaped geometry . . . Archimedes physics.

Xenophanes gazing upon the Heavens saw them to be one. Copernicus placed central in that one, our shining sun.

In the motions of physical bodies Galileo beheld law; thence Newton and the principle of universal gravitation.

Democritus glimpsed the atomic theory of the structure of matter; Dalton established it.

When in the nineteenth century Lamarck and Darwin formulated the great principle of organic evolution, the science of life was first seen as a cosmic progression of nature.

For the saving of life through inoculation men give honor to Jenner and Pasteur.

The century of progress saw Oersted and Faraday set forth, and Maxwell and Hertz advance the theory of electromagnetism.

Through the labors of Becquerel, of the Curies and of Thomson, to our own day are revealed fragile atoms and electrons.

Planck's quantum and Einstein's relativity theory open new epochs to science.

From the vast literature of science fourteen quotations have been selected and written upon a wall of the Hall of Science as a concise summary of scientific philosophy. Poets and public men as well as scientists are among those who wrote the collected sentences. The quotations are as follows:

Science and peace will triumph over ignorance and war.—Pasteur

Man is the interpreter of nature. . . . Science the right interpretation.—Whewell

Nature never proclaims her secrets aloud, but always whispers them.—John Owen

Science has but one fashion. . . . To lose nothing once gained.—Stedman

There is nothing so powerful as truth, often nothing so strange.—Daniel Webster

Scientific education is an essential condition of industrial progress.—Huxley

If there is one way better than another, it is the way of nature.—Aristotle

The first and the last thing required of genius is the love of truth.—Goethe

Nature is not to be governed except through obeying her.—Bacon

More important than particular truths is the love of truth.—C. J. Little

The common experiences of normal people are the matter of science.—H. Dingle

Reason's voice and God's, Nature's and duty's, never are at odds.—Whittier

The essence of science is to discover identity in difference.—F. S. Marvin

Scientific law is a description, not a prescription. —Karl Pearson

Mechanical men reveal to the visitors of the exposition the physiology and chemistry of the human body.

The famous transparent man, manufactured in Germany, as a life-sized display of the vital organs of human anatomy is a central exhibit in the medical section of the Hall of Science.

An American robot, ten feet high, who speaks and gestures and explains an illuminated interior view of himself, is a part of the chemical exhibit.

The life-size model transparent man, obtained from the famous Hygiene Museum at Dresden, has his exterior made of a synthetic transparent material. Heart, lungs, the stomach, liver and other interior organs are lighted in rotation to show vividly to the visitor their relation to the surface of the skin.

"Now, ladies and gentlemen, I shall swallow," the chemical robot tells his audience many times each day in exhibiting the mechanical movements of his stomach and intestines by illuminated dynamic pictures of his interior. "You will see the mouthful of food passing down my esophagus. The food is forced down by the contractions of the esophagus. Now you see the swallow entering the top door of my stomach. Watch my stomach contract to churn up the food."

The robot, who is a handsome well-dressed young man, except for the fact that his upper garments are pulled aside to show his digestive area, can point to the various happenings within him. He gives practical advice to the audience upon nutrition and the kinds of food that should be eaten.

A talking motion picture provides both the speech and the interior views of the robot, while ingenious mechanisms allow him to wave his arms when he orates.

Automatically and continuously, one of the many chemical exhibits is making gunpowder by mixing carbon, sulfur and niter and then exploding it before the eyes of the visitors by dropping it on a hot plate.

In other Century of Progress exhibits which show the principles and processes of chemistry that underlie our modern civilization, fire and sparks flash as there are repeated by the self-operating exhibits some of the famous and fundamental experiments that have made history.

Once a minute for ten hours each day, a dynamic display heats mercuric oxide in a test-tube and shows that metallic mercury, such as is contained in thermometers, and oxygen gas are given off. This repeats the experiment that resulted in the discovery of oxygen.

A ribbon of iron is burned in oxygen with a brilliant display of fire and another element, phosphorus, is allowed to burn simply by exposing it to the air.

Every two minutes in another booth the famous thermite reaction used in one kind of welding is performed to show the principle of chemical exchange or double decomposition. Iron oxide is mixed with aluminum dust and when the mixture is ignited there results molten iron and aluminum oxide.

That water can start fire is proved by an experiment in which the metal potassium is dropped into water with the result that it burns.

The breaking up of water into hydrogen and oxygen gas by an electric current is shown in another experiment and then these two gases are recombined into water by allowing them to burn.

Some materials cause a chemical change to take place without themselves participating in it. Such a catalytic action is illustrated by an operating experiment which shows ammonia being turned into powerful nitric acid. Before the catalytic change, the ammonia gas is basic and therefore turns a litmus solution blue when it is bubbled through it. After it is made into an acid a litmus solution is turned pink by the nitric acid gas bubbling through it.

Because sulfuric acid is one of the basic chemicals of modern industry, its manufacture is explained. The mining of the sulfur from the ground, its conversion into sulfur dioxide by burning, and its transformation into sulfuric acid by the catalytic contact process is carried out before the eyes of the visitors. Ninety-nine per cent. pure sulfuric acid is produced and the Cottrell electrical precipitator is seen changing the fog of sulfuric acid into a heavy liquid.

In another booth a dazzling color display of actual crystals being produced from a liquid and projected on a screen is to be seen.

Cherry red gold, the precious metal in finely divided solid suspension in a liquid, may also be seen. This is colloidal gold. A little acid added automatically to the solution turns the red gold to blue and then when more acid is added the gold is completely thrown down out of solution.

How gold mined from the earth is extracted from the rock is demonstrated in a complete ore flotation unit, where the gold ore is crushed, pulverized and then put through the flotation process to separate it from the lead and zinc sulfide with which it is associated.

A rubber tree with its latex sap flowing out of a gash in its bark is another exhibit which is the starting point for a complete story of the utilization of rubber in industry. Electroplating with rubber and vulcanization processes used in making automobile tires are shown in actual operation.

An automatic chromium plating plant built especially for the exposition will demonstrate this new process of electroplating as it produces appropriate souvenir letter openers which have impressed upon them a representation of chemistry's fundamental periodic table.

SCIENCE NEWS

Science Service, Washington, D. C.

MATTER CREATED FROM LIGHT AND COSMIC RAYS

TANGIBLE matter is being created out of light and cosmic rays which come to earth from outer space. Radiation produced here on earth is also manufacturing in some proved instances matter out of intangible waves.

Conversion of mass of the stars to produce light and heat has been the favorite method of explaining their long life. That has been the classic example of the interchange of matter and radiation.

Now evidence is accumulating for the reverse process, the creation of matter out of radiation, not in the far-distant stars, but here on earth.

The idea that matter is created by light or photons was put forth by Dr. P. M. S. Blackett and G. Occhialini, of the Cavendish Laboratory of the University of Cambridge. The light prefers to perform this miracle only in the neighborhood of an atomic nucleus. The matter is created in the form of a pair of electrons, one positive and one negative. The theory is formulated on the basis of Dr. Carl D. Anderson's discovery of the positive electron and the subsequent confirming researches at Cambridge.

Experimental evidence for the creation of matter is contained in the bursts of electrons due to cosmic rays observed by Dr. Anderson in his apparatus at the California Institute of Technology. And Dr. Anderson recently found pairs of electrons formed by the gamma rays given off by thorium. The positrons or positive electrons so formed do not live long, however, since they unite with negatives to form photons or light again.

The latest development is that Dr. J. R. Oppenheimer, of the California Institute of Technology, and Dr. Milton Plesset, a National Research fellow, have found that the theoretical equation of Dr. P. A. M. Dirac is quite in accord with the facts. This has led to important predictions bearing on cosmic rays.

Photons of high energy much prefer to produce the pair of electrons than to transfer their energy to a single ordinary electron. All of the photons or cosmic rays are equally effective in producing new pairs.

After discussing these new developments at Pasadena, Dr. Niels Bohr, the Danish physicist who is spending some weeks at the California Institute of Technology, commented that the calculations by Drs. Oppenheimer and Plesset have convinced him that the Dirac equation instead of being false is the greatest acquisition to human knowledge in the past few years.

MUSCULAR WEAKNESS IN GRAVES' DISEASE

THE extreme muscular weakness that marks Graves' disease has a chemical basis and is not just due to the nervousness which also features the ailment, Drs. E. Shorr, H. B. Richardson and H. G. Wolff, of the Cornell Medical School and New York Hospital, reported at the Washington meeting of the American Society for Clinical Investigation.

This is a disease involving the thyroid gland. Some patients suffering from it have marked goiters and bulging eyes, as well as the nervousness, muscular weakness and increased metabolism. The disease is also marked by the excretion from the body of large amounts of a chemical substance called creatine.

Creatine is present in the muscles as part of the compound phosphocreatine. When muscles contract, this compound breaks down into creatine and phosphoric acid. In the recovery of the muscle the two substances are recombined into phosphocreatine. If the latter substance is not adequately rebuilt in the muscles, they will fail to function properly. In Graves' disease, one of the parts, creatine, of the essential phosphocreatine is excreted from the body in abnormal amounts instead of being completely recombined with phosphoric acid.

This abnormal excretion of creatine also occurs in another condition known as progressive muscular dystrophy, characterized by marked muscular weakness associated with degenerative changes in the muscles.

These investigators found many points in common between the two conditions. Most of the chemical reactions formerly considered characteristic of the creatinuria of muscular dystrophy were consistently found by them in patients with Graves' disease. An additional point of resemblance between the two conditions is that actual muscle degeneration, especially of the eye muscles, has also been observed in Graves' disease.

These observations do not imply that these diseases have a common origin, but suggest that a similar damage to the important phosphocreatine mechanism is sustained in both, and is responsible for the muscular weakness.

For these reasons, the creatine excretion in thyroid disease is regarded as potentially dangerous to the functional and anatomical integrity of the muscles. It can be abolished by giving iodine, which has long been established as an important therapeutic agent in Graves' disease.

CHEMICAL WARFARE BY INSECTS

CHEMICAL warfare with special weapons is waged by certain species of insects in India, according to Dr. Thomas E. Snyder, of the Bureau of Entomology, U. S. Department of Agriculture. Dr. Snyder has recently completed a study of a large collection of these insects in the U. S. National Museum.

The insects are termites, often incorrectly called "white ants." Termites are not ants, and are related to them only insofar as both termites and ants are insects. Ants, indeed, are among their worst enemies, and it is against ants that the chemical weapons studied by Dr. Snyder are most effectively employed.

The termites bearing these weapons belong to a special "caste" within the termite nest; they are developed for defending the colony just as others of their nestmates are specialized into a worker "caste." In these particular species the soldier termites have as chief weapon a long protrusion from the front of the head. Originally

it developed from a third eye, but now its function is to secrete and discharge a powerful corrosive acid. Some of them can squirt it almost an inch, but such cases are exceptional.

When enemy ants invade the termite nests guarded by these chemically armed warriors, the latter rush to the combat. They know the weak spot in their opponents' armor, and go straight for it. Shoving their long snout-like weapons against the ant's "waist" or pedicle, they smear it with the corrosive secretion. The ant quickly becomes helpless.

Termites, whose depredations in wooden structures in New York have recently caused something of a stir, are primarily animals of the tropics, although a few destructive species have become widely distributed over the southern and eastern parts of our own country. They feed primarily on wood and other cellulose substances, and can cause immense damage if not guarded against. In the tropics they can hollow out a house and all the wooden furniture in it, besides eating up all books, stored clothing, and almost any other vegetable fiber they can fasten their jaws into.

THE CAUSE OF FATAL DISEASE IN YOUNG LAMBS

DURING the California lambing season, a disease hitherto of unknown origin has inflicted heavy losses upon newly-born lambs on farms that are widely separated.

Dr. Hilda Hempl Heller, while at Hooper Foundation for Medical Research of the University of California, fastened the apparent guilt of causing this disease upon one kind of the very common colon bacilli, the sort of germs widely found in the intestinal tract of animals.

An unusual circumstance of this disease is that, though it is an infection, the mechanism of its action resembles that of a food poisoning. The little lamb, just after being born, drinks its mother's milk, which is not poisonous. When in some way it is infected with the colon bacillus at a virulent stage, the germs form a poison in the milk within the lamb's alimentary tract. The lamb dies from absorbed poison rather than from the direct attack of the germs.

The germs charged by Dr. Heller with causing the disease are extremely variable and they have been found to change their deadliness rapidly.

Dr. Heller, who is an authority on botulinus poisoning, began work on the disease because it was thought that it was a disease caused by an anaerobe, or air-hating germ. She found that a powerful poison was present in the lamb intestines, of which five drops would kill a mouse in two and a half hours. The blame for forming this poison could not be fastened upon any anaerobic germ.

The poison-producing power of the colon bacilli found in the lambs was then demonstrated by Dr. Heller. When grown in test-tubes the isolated germs produced a poison identical in effect with that obtained from the lambs. Dr. Heller, who worked on this problem with the cooperation of the University of California's Division of Veterinary Science, located at Davis, California, did not have the opportunity to clinch the proof by infecting lambs, because when the presumably guilty organism was isolated and proved to be rapidly fatal for guinea-pigs, the lambing season was over.

Dr. Heller hopes to be able to continue research upon this lamb disease. It seems probable that it is widespread in the sheep-raising areas of this and other countries, and must cause a loss amounting to many thousands of dollars annually. It may also be related to a similar disease of calves which is responsible for even larger financial losses.

THE WHEAT CROP

WINTER wheat in the United States promises the shortest crop since 1904, the May issue of *Wheat Studies* of the Food Research Institute estimates. The official forecast as of May 1 indicated a crop of only 337 million bushels, 125 million below the standing estimate of last year's crop. Acreage abandonment was unprecedentedly high, over 32 per cent., leaving the smallest area for harvest since 1912.

Reports of farmers' intention to plant spring wheat indicated that the acreage sown this spring in North America may be four or five per cent. smaller than the area planted in 1932. Since the publication of the institute's report, unfavorable weather has held back spring wheat planting, along with practically all other crops, so that some shortage in spring wheat may be expected also, though whether it will be as great as that in winter wheat can not now be predicted.

One major wheat harvest of the world, that in India, has already been reaped. It is officially estimated at 340 million bushels, a trifle larger than the 1932 crop. It is not expected that the Indian crop will have much influence on world wheat prices during the May–July period.

European wheat-importing countries are still striving for as much self-sufficiency as possible in wheat. They are expected to harvest as large an area as last year's, if not a little larger, but the crop is expected to be smaller by 100 to 150 million bushels. This will be at least partly balanced, however, by a larger crop anticipated from the great wheat-exporting regions on the Danube, where last year's crop was a virtual failure in Rumania and Jugo-Slavia.

In Russia the area sown to winter wheat was more than four million acres smaller this year than last, and spring wheat plantings will probably be no larger. But even if the crop increases, as is fairly likely, much of the early surplus normally exported will have to go for the relief of the domestic food shortage.

Prices on wheat are expected to advance, but more from currency and general economic causes than because of crop conditions.

The current report of the Food Research Institute was written by M. K. Bennett and Helen C. Farnsworth, with the advice of Joseph S. Davis and Holbrook Working.

THE PURE FOOD AND DRUG BILL TO CONGRESS

AT the direction of President Roosevelt, Secretary of Agriculture Wallace has sent a bill for a new national pure food and drug law to Congress.

The new bill has been carefully planned to remedy the deficiencies of the present food and drug law, which

was enacted nearly 27 years ago after a strenuous campaign by the late Dr. Harvey W. Wiley.

The limitations of the present law make it impossible to carry out its intention of protecting the public from impure or harmful foods and drugs, Secretary Wallace pointed out in submitting the new bill.

Under the new bill, the secretary is authorized to set definitions and standards of purity for foods, just as there are now legal standards for official drugs. Under the present law such standards may be set for canned foods only.

False advertising is to be prevented under the new bill. At present there is no way, under the Food and Drugs Act, to control the serious abuses in this field.

The present law prohibits false or misleading statements on the labels of foods and drugs, but under the new bill, labels must tell enough about the product so that the consumer will know what he is getting and can buy intelligently and discriminatingly.

Cosmetics are to be brought under federal control so as to prevent the serious injuries that have occurred through the sale and use of harmful cosmetic products.

Another important feature of the bill is the provision directed at the sale of drugs labeled as treatments for various diseases. The Food and Drug Administration under the new bill will be able to prevent the sale of such drug products if the claims for them are contrary to general agreement of medical opinion. At present an influenza cure, for example, which physicians agree will not remedy influenza, can not be kept off the market unless the Food and Drug Administration can prove that the claims for the remedy are not only false but made with the intention of deceiving the public.

ITEMS

DIFFICULTY in measuring the energy of cosmic rays presents the greatest problem to the physicists studying them, Dr. R. A. Millikan stated in a discussion following a summary of recent experiments presented by his colleague, Dr. H. Victor Neher, at the California Institute of Technology. Dr. Paul S. Epstein presented a very successful theory which pictured the cosmic rays as a stream of photons accompanied by several weaker groups of electrons. But the experimenters were warned against accepting theories until energy measurements of the rays became more complete. Meanwhile, all investigations indicate that photons predominate in cosmic rays, but that some electrons also enter the earth's atmosphere. A strong support for the photon idea was presented by Dr. Carl D. Anderson, who announced that he had produced positive electrons or positrons with photons from thorium. If photons are known to produce positrons and if no other method is known then the positrons which are found with cosmic rays were probably produced by photons too.

INTRODUCING "deuton" as a new name for the double-weight hydrogen atom only known to science for a little over a year, Professor Ernest O. Lawrence, of the University of California, reported to physicists meeting at Pasadena what happens when the heavy isotope of hydrogen is used as a projectile in smashing various elements. Only about a month ago, Dr. Gilbert N. Lewis supplied Professor Lawrence and his associates, Drs. Henderson and M. Stanley Livingston, with some deutons. The atom-smashing was done with the aid of potential up to 1,500,000 volts imparted to the deutons with Professor Lawrence's magnetic method of creating high voltages. Lithium, beryllium, boron, nitrogen, fluorine, aluminum and sodium gave good results. Transmutations occurred, alpha rays were formed, and probably other processes yet to be examined followed.

SPECTRA lying between the x-rays and the ultra-violet rays of 1,200 Ångstrom units, in which absorption spectra have hitherto been unknown, have been found by Dr. H. Beutler, Berlin physicist. The elements giving the newly discovered spectra are rubidium, caesium, cadmium and mercury. Helium was exposed to a condensed discharge to produce light from 900 to 600 Ångstrom units. The light source and the test vapor could not be separated from the vacuum spectrograph used by a window or other device because no material known allows these rays to pass through. The new lines can not be observed in emission but only in absorption. They are interpreted as arising from a change in the quantum numbers of an inner electron while the valence electrons remain unexcited and they thus represent a transition from optical to Roentgen spectra.

DR. JAMES CHADWICK, of Cambridge, discoverer of the neutron, delivering the Bakerian lecture of the Royal Society, awarded a tentative decision against the neutron as the cause of formation of the positron, another newly discovered particle of matter, when radiations from radioactive beryllium pass through a lead plate. The radiation from beryllium consists of neutrons and gamma rays. The neutron can be thought of as a corpuscle, but gamma rays are like light, x-rays and radio waves in being electromagnetic waves. Positrons or free positive electrons are produced by atom smashing when the mixed beryllium radiation is allowed to attack lead. The neutrons were accused at first, but now Dr. Chadwick believes that the gamma rays, not the neutrons, may be responsible. Out of 300 electron tracks produced in his experiments, 200 were made by the familiar, long-known negative electrons, while 70 were positive. Dr. Chadwick's work at Cavendish Laboratory agrees generally with researches by Dr. Carl D. Anderson, of California Institute of Technology, who last fall discovered the positron.

BEAUTIFUL phosphorescent light given off by certain sponges living in shallow waters is really due to small worms that inhabit them, according to Professor Emanuel Trojan, of Prague. The little light-producing worm is scarcely a quarter of an inch long, but can send branches an inch and a half in all directions. Professor Trojan tells *Nature* how he coaxed the little animal out of its hiding place by attaching the sponge to the edge of an inclined bowl, allowing the water to drip slowly out of the sponge into the bowl. As the sponge became too dry for comfort, the water-loving worms came out of their hiding-place.

SCIENCE NEWS

Science Service, Washington, D. C.

THE FIFTH PACIFIC SCIENCE CONGRESS

FISH are commonly reputed to be voiceless, yet some species can make sounds that apparently serve as calls to their mates. So stated Dr. Shinkishi Hatai, marine biologist of the Tohoku Imperial University, Japan, before the meeting of the congress at Vancouver on June 5. Several species of fish produce distinct sounds, he said, either by friction of the fins, grinding their teeth, emitting air through a narrow passage or through special developed sound-producing organs. These sounds may serve as warnings as well as for mate-calls. Dr. Hatai developed this point during a discussion of the sensitiveness of fish and other marine organisms to vibrations in general. A very little movement of a boat's oars served to attract to his boat numerous specimens of the handsome red Japanese fish called "tai" at a distance of forty yards. This sensitiveness of fish to changes in their environment, imperceptible to human organs or man-made instruments, may have considerable importance, both scientific and economic, in connection with the almost incessant earthquakes with which Japan is visited. Before two recent rather severe earthquakes the uneasiness of the sea fish in certain regions was noted. On both occasions they consistently refused baited hooks. The consequences of an earthquake that changes the level of the sea-bottom may be revolutionary to the animal societies living on it or in the water above it. Most bottom communities are adjusted to a given depth of water, as it affects quality and intensity of light, oxygen concentration, and other factors. In turn, these anchored animals and plants are related to the swimming animal population in the rôles of food, shelter, enemies, etc. An earthquake that revolutionizes the life balance on a given stretch of sea-bottom may very well ruin a whole fishing community, though it does not wreck a house or a boat, simply through the changes it brings to pass in the animal communities that constitute the support of the people.

THE ups and downs of the isthmus that at various times in the past connected the continents of North America and Asia where now the Bering Strait separates them were described by Dean Edward W. Berry, of the Johns Hopkins University. This land bridge, over which the two continents exchanged plant and animal populations, has been above water some five separate times during the Age of Reptiles and the succeeding Age of Mammals. Its most recent emergence was during the Pleistocene or great Ice Age, when woolly mammoths and giant bison tramped back and forth across it.

THE rocks underlying the Pacific Ocean are different from those of the other ocean basins of the world as well as from those of the land areas, according to Dr. B. Gutenberg, of the California Institute of Technology. The granites and sedimentary rocks that make up the bulk of the continental masses are absent, as are also the basic rocks that underlie them and form the floors of the other oceans. Instead, the Pacific bottom appears to consist of even more strongly basic rocks, that may continue downward without any sudden change to a depth as great as 1,200 kilometers (about 725 miles). Dr. Gutenberg has been led to these conclusions by a study of the rates of earthquake-wave travel through various regions of the earth.

SEA-LEVEL is not strictly on the level. It is higher in some places than it is in others, according to H. G. Avers, chief mathematician of the division of geodesy, U. S. Coast and Geodetic Survey. At Prince Rupert, B. C., mean sea-level is 1.64 feet higher than it is at Halifax, N. S.; at Seattle it is 1.18 feet higher than at Portland, Maine, and at San Diego, California, it is 1.74 feet higher than it is at Fernandino, Florida.

BOTANISTS at the congress heard from Dr. W. L. Waterhouse, of the University of Sydney, Australia, of the quandary into which the wheat breeders of his country have been thrust by the mysterious behavior of a parasitic fungus, the rust disease of grains. They had been used to fighting several well-known, almost standardized forms of this disease. Suddenly there appeared an entirely new form of grain rust, which has quite displaced the enemies they had become used to and could deal with fairly effectually. This new foe is the more troublesome since all Australian grain varieties are extremely susceptible to it. Nobody knows where it came from or how it got to Australia.

THE great unpopulated spaces of the North, ranged by wild animals good for food and fur, can become a permanent reservoir of these supplies if properly administered, Dr. R. M. Anderson, biologist of the Canadian Department of Mines, reported. Furthermore, the fauna of the Canadian and Alaskan North are of high scientific interest, because of the many suggestions on the origin and migration routes of large mammals which they offer.

GLAMOROUS ideas, bred largely in Hollywood studios, about the simple idyllic life of "primitive" South Sea tribes received a jolt at the hands of Professor R. Thurnwald, of Yale University, who spoke before the congress. Their lives are anything but paradisiacal and their culture anything but simple, he said. To that extent at least they can not be said to be primitive. Neither is it possible to assume a common origin of two groups because one finds a few traits in common between them, like similar language or a similar way of building houses or hunting heads. A group in its history and migrations may borrow customs from many of its neighbors. Professor Thurnwald told of finding a people on the northern coast of New Guinea who used a Papual vocabulary with a Melanesian grammar. It reminded him, he said, of a community of Negroes in one part of Texas, whose language is a Bavarian dialect. Their one-time German masters have long since moved away and blended with the general American population, but these Afro-Americans keep the old speech.

THE MEDICAL MEETINGS IN MILWAUKEE

PHYSICIANS of the future apparently are going to know their economics and the business side of medicine. No longer will the saying be true that physicians, along with other professional men, are not socially minded and have no knowledge of economics. An outline of medical economics to be used in medical schools is being prepared by the American Medical Association, as announced at the opening session of the annual meeting on June 6. This is to meet the increasing need for persons starting to practise medicine to have some information concerning economics, ethics and organization.

CONTROL of narcotic drugs should be a function of state rather than of the federal government, according to the legal department of the American Medical Association. A uniform narcotic law, such as has been recently adopted by Indiana, Nevada and New York, was urged by this committee. Efficient state control will be better able than federal control to prevent the abuse of these drugs. "Unless the individual states strengthen their efforts in this direction, the federal government may attempt to take over the production, manufacture, distribution and use of narcotic drugs under its treaty-making power. This would result in the loss by the states of their right to authorize physicians to prescribe narcotics and thus there is partial control of the practise of medicine by a Washington bureau. The people of a state pay for enforcement of federal narcotic laws when they might more economically enforce a state law."

THE physician of the future may become an "immunisator" or even something of a regulator of body and even of mind, according to Dr. Clyde Brooks, of New Orleans, at the meeting of the American Medical Association. Dr. Brooks discussed the present status of treating diseases by injecting foreign substances into the body. One example is use of specific vaccines made from killed or weakened germs of the disease, such as anti-typhoid inoculations. Another example of this type of treatment is the use of substances such as egg white or milk which have no connection with the disease. These are used on the theory that introducing any foreign material into the body will call out all its defensive forces against the invading disease. When the treatment uses a specific vaccine, as in typhoid fever, the process is said to be one of producing immunity to the disease. From this Dr. Brooks suggests the title "immunisator" for the future physician who, he believes, may treat diseases of the body and even of the mind largely by immunologic methods. The present status of this field, however, is like a jigsaw puzzle, he said. There are many isolated areas of information, some of which fit together to give a glimpse of some of the figures in the final picture, but no one yet knows what the picture will be. But enough is known to convince workers that the physician of the future will treat the sick largely by immunization.

THE vital cortex of the adrenal glands may have an influence on the regulation of salt and water in the body similar to that of insulin on sugar, the parathyroid glands on calcium and the thyroid gland on iodine. Evidence indicating that this may be the case was presented by Dr. R. L. Zwemer, of the College of Physicians and Surgeons, Columbia University, and his associate, Dr. Ruth Sullivan, at the meeting on June 8 of the Association for the Study of Internal Secretions. The salt in this case is sodium. According to Dr. Zwemer it is a loss of sodium from the body rather than any great increase in acid that produces the lower carbon dioxide combining power of the blood which is an early indicator of insufficient functioning of the adrenal glands. In cats that have lost their adrenal glands, extract of the adrenal cortex increases the amount of sodium and chloride in the blood. Drs. Zwemer and Sullivan working with animals, and Drs. Robert Loeb and Dana Atchley treating patients, found that giving common salt by mouth is helpful in conditions like Addison's disease in which the cortex of the adrenal gland is not producing enough of the necessary hormone. Cats that were given salt after removal of the adrenal glands survived twice as long as similar animals that got no salt. While salt is helpful in these conditions of adrenal insufficiency, some of the adrenal cortex hormone or extract must also be given.

A NEW, hitherto unrecognized glandular disorder was reported by Dr. Leonard G. Rowntree, of Philadelphia, and Dr. Louis A. Brunsting, of the Mayo Clinic, to the Association for the Study of Internal Secretions. The disorder was seen in two young women, twenty years old, who were brought to the Mayo Clinic because they had suddenly become very fat. They could not get rid of the excess weight by any of the measures for reducing. "Both patients were superlatively feminine in appearance with luxuriant hair and exaggerated feminine configuration," the physicians found on examination. Both patients had matured at a younger age than the normal. With the idea that the obesity was due to derangement in the body's handling of water, the patients were given treatment to remove the water from their bodies. This was done by the use of ammonium salts and the newer mercury compounds. As a result, the weights of the two patients were reduced to practically normal. After their return home, one patient regained the weight she had lost. The other patient was able to keep her weight down by continuing the ammonium and mercurial compounds and by restricting the amount of water she took. Drs. Rowntree and Brunsting suggested that the condition might be the result of an early excess of one of the hormones of the pituitary gland, known as Prolan A.

CHILDREN are more flexible than adults in their bodies' readjustment of sugar utilization in various conditions, according to studies of Dr. Henry J. John, of the Cleveland Clinic, reported at the meeting of the Association for the Study of Internal Secretions. He studied the sugar tolerance of groups of children from 4 to 20 years old who were suffering from various conditions that might affect the sugar utilization and compared this with the tolerance of adults suffering from the same ailments. These were obesity, hyperthyroidism, rheu-

matic disease and pituitary disease. The part played by infections in upsetting the sugar utilization may be temporary or permanent diabetes. "Diabetes is looked upon mainly as a degenerative disease, rising rapidly after the fourth decade and reaching its maximum in the seventh decades."

BOTH the birth rate and the health of new-born babies are affected by the season of the year, Dr. Lee Bivings, of Atlanta, Georgia, found from a study of Negro infants in his city. The diet of the prospective mother and the amount of sunshine also apparently influence the birth rate and infant health. The birth rate for 1930, 1931 and 1932 was consistently higher in the winter quarter. This fact suggests that the mothers who had the benefit of spring and summer sunshine in the period before the babies were born were more likely to give birth to healthy children. The average weight of babies born in 1931 was higher than that of babies born in 1932. While many factors were involved, Dr. Bivings believes the greater amount of sunshine in 1931 had some influence. This opinion was borne out by the fact that babies born in Los Angeles, St. Petersburg and Atlanta, Georgia, weighed more than those born in Iowa City and New Haven, Connecticut. The studies showed that the health of the babies was not as good when their prenatal life began in the winter. Dr. Bivings explained this on the ground that it is during the winter months that the prospective mother's diet lacks sufficient vitamin B which is believed to have an important effect on the prenatal development of a child. These are likewise the months of least sunshine.

AS a result of careful control by the Department of Agriculture of the spraying of vegetables and fruits to check insect pests few products with a dangerous arsenic content reach the consumer, it was stated at the meeting of the American Medical Association on June 15. The statement was made in the course of a discussion by W. V. Evans and H. H. Rowley, chemists of Northwestern University, on the dangers of poisoning from these sprays. Successful use of the spray method of fighting the boll weevil in cotton led to enormous increase in this method of fighting insect pests. Sprays began to be used in wholesale quantities in every kind of crop. The growth of truck farming has also had an influence in the increased use of sprays, because the greater concentration of foodstuffs in this type of farming led to an increase in insects. The sprays most often used contain chiefly arsenic and lead, both deadly poisons to human beings. The danger of acute poisoning is not so great as that of cumulative poisoning, which may result from consumption of these substances over long periods through the residue left on fruits and vegetables. Chemical solvents to remove the arsenical residues have been found effective. A solution of hydrochloric acid is recommended for fruits. Stripping the outer tainted leaves of such products as celery and cabbage removes the poison residue. Government workers are actively engaged in seeking non-poisonous sprays that will be as effective in protecting the crops.

ITEMS

LONDON'S new Museum of Practical Geology had a strange début for a museum on June 12. Its construction was hastened to completion so that the fifteen hundred delegates to the world economic conference might move in. Exhibit halls have been turned into conference rooms, reception rooms and lounges for the delegates. The great central hall was the formal meeting place for the sessions, with rows of desks installed and a dais where the King of England stood on the opening day to greet the conferees. The institution which will take over the new building when the conference departs was established in 1837, through efforts of the founder of England's Geological Survey, to preserve specimens of ores and metals and gem stones collected by the survey. Its new home is a dignified structure of white stone located between the Science Museum and the Natural History Museum in South Kensington.

SUDDEN hot weather and a cessation of rains, coming on the heels of a most persistently wet, cold spring, has already undone much of the mischief wrought by the earlier unfavorable conditions, a survey by the U. S. Weather Bureau has disclosed. Over most of the grain belt states, where spring planting was held back until farmers had begun to be alarmed, the bulk of the crop is in. Farmers have put in extra long hours at the planting, in many cases working late at night. The high temperatures, ranging from 10 to 13 degrees above normal, have favored the quick germination and growth of the crops. On the basis of past records, the weather during May and to date in June should be favorable for a good yield of spring wheat.

SCIENTIFIC study of birds, which has been conducted by the Commonwealth of Massachusetts for many years, has been brought to an abrupt end by act of the Legislature, as interpreted by the Commissioner of Agriculture. The state ornithologist has been dismissed and all files containing data on birds have been placed in storage. All inquiries concerning birds, whether purely scientific or bearing on such economic aspects as game-bird distribution and habits, oil pollution and the relation of birds to special crops, will be answered only by a brief statement that the commonwealth has no information available.

WITH seven leaflets to each leaf instead of the usual three, and big in all its parts, a new giant clover species has been discovered in the state of Washington by J. W. Thompson, of Seattle. It was growing on dry sagebrush slopes near the mouth of Swakane Creek, Chelan County, Washington. Mr. Thompson sent a specimen to the U. S. National Herbarium, where it was examined by C. V. Morton. Mr. Morton found it to be a plant hitherto entirely unknown, and therefore gave it a technical description in the *Journal* of the Washington Academy of Sciences. He named it *Trifolium thompsoni*, in honor of its discoverer.

SCIENCE NEWS

Science Service, Washington, D. C.

A METHOD for detecting a strange disease, argyria, in its earliest stages, was reported to the American Medical Association, meeting in Milwaukee, by Dr. Irving S. Wright, of the New York Post Graduate Medical School of Columbia University.

Argyria is a condition in which the patient turns a greyish-blue color. In the final stages the color is very pronounced, and if the patient is exposed to sunlight, his skin turns a very dark mahogany brown. The condition is becoming more common all the time. There is no way of treating it. Argyria results from taking medicines containing silver salts for a long period of time. Such medicines are often given in the treatment of nose and throat ailments. Frequently patients who have used these medicines under a physician's directions will use them again on their own initiative when suffering a repetition of the nose and throat ailment.

Formerly it was thought that the blue discoloration, which makes its first appearance around the base of the nails, was due to stoppage of the blood flow through the tiny blood vessels, the capillaries. But Dr. Wright and his associates have recently developed a microscope for observing the capillaries and watching the blood flow through them. When they used this apparatus to examine the capillaries of the nail cuticle in cases of argyria, they found that there was no stoppage of the blood flow and no evidence of congestion. This led to discovery that continued administration of silver-containing medicines results in the precipitation of silver albuminate in the tissues, which produces the blue color.

Once the color is established, there is no satisfactory remedy for the condition. But if the first appearance of it around the nails is noted and the dosage of silver-containing medicines stopped, it is believed the condition will not go farther. While the condition does not impair the health, it is most disfiguring.

Dr. Wright used the capillary microscope to examine another group of patients. These are a class in whom several observers had found that the surface of the fingers was actually colder after smoking one or several cigarettes. Dr. Wright and associates observed that in a few of these patients they could detect with the new apparatus a slowing down and occasionally a stoppage for several seconds of the blood flow in the capillaries of the nail cuticle. This accounts for the drop in temperature, but the constituent in tobacco which produces this effect is not known at present.

This and other methods of examining the blood vessels and for determining surface temperature of the hands and feet were shown in an exhibit sponsored by the association and contributed to by the New York Post Graduate Medical School, the Mayo Clinic, Northwestern University, the University of Pennsylvania, the University of California and the Presbyterian Hospital of New York. These new methods have enabled physicians to make early diagnosis of a number of diseases of the extremities formerly considered hopeless. As a result the conditions may be greatly relieved by surgical and medical treatment.

SKULL change is a new key to the past function of the gland which influences growth, sexual development and possible mentality. Studies showing this were reported by Dr. Hector Mortimer, of Boston, to the Association for the Study of Internal Secretions. It appeared from his report that the history of the functioning of an individual's pituitary gland throughout his life with all that tells of the individual's health and physical and mental development, can be read in changes in his skull that may be seen in x-ray photographs.

Four basic types of skull changes were found by Dr. Mortimer and Drs. George Levene and Allan Winter Rowe, of Boston, after a review of a collection of documented acromegalic crania in museums in America, England and Scotland. The first type is characterized by expansion of the face and sinuses, especially the frontal sinuses. This expansion changed, affecting all bones and mechanically producing the well-known deformities of acromegaly, including the large jaws. The second type is characterized by a small head, small face and very dense skull. This chiefly affects women who are usually fat, and is a sign of failure of the gland, not of over-activity as in the first type. The third type begins as a type one, with over-active gland; the gland subsequently fails and the bones become dense like old bones, even in young people of eighteen. Failure of the gland is, in other words, premature aging of the individual. The skull becoming dense, which means not that it is thick, but that it is so compact as to be almost like ivory, is an indication of failure of the gland. This is a feature of both groups two and three. In these groups there are ten times more women than men. The mechanism behind all this accounts for the fact that women age more quickly than men and are more liable to become stout. The fourth type of skull change is found in dwarfs and other persons whose pituitary gland has never been fully active. This type can be recognized by failure of the frontal and other sinuses to develop completely. In many of these persons the frontal sinuses never develop at all. This gland failure also means that the sexual development is much below par or even absent.

BONE development is now being used as a guide in treating certain children who are mentally retarded or emotionally unstable. Dr. E. Kost Shelton, of Santa Barbara, California, has found the stage of bone development, or bone age, a good index to the speed with which certain vital transformations are going on in the body. These transformations are the processes by which energy for the body's activities is obtained from the burning of food and oxygen. When these processes,

called metabolism, proceed at either too fast or too slow a rate, the health is seriously affected.

Dr. Shelton found that the bone age, which can be determined by x-ray examination, is correlated with the metabolic rate, and can be used as a guide in treatment of certain types of disordered metabolism. "Any metabolic disorder in childhood, when sufficiently severe to produce mental or emotional symptoms, will be reflected in bone development." He believes that the rate of bone development is determined by the metabolic speed and therefore is the best guide to the latter. Dr. Shelton described a number of patients suffering from retarded growth and defective mental development, in whom he also found very much retarded bone growth. Treatment with extract from the thyroid gland, which speeds up the rate of metabolism, improved markedly the condition of the patients. Additions of vitamins A and D and feeding an otherwise adequate diet had no effect on metabolic speed or the developmental age.

THE death rate from one type of pneumonia can be cut in half when serum is used in treatment during the first four days of the disease, according to a report presented by Drs. Gaylord Anderson and Roderick Heffron, of Boston. They gave details of a study made by the Massachusetts State Department of Health. Pneumonia takes a terrific toll at the economic prime of life. It is practically impossible to prevent pneumonia through such measures as quarantine or vaccination. In two of the types, however, it is possible to modify the course of the disease by injection of serum during the first few days. Poor economic status with unhealthful living conditions does not influence the occurrence of pneumonia or the mortality, evidence from another phase of the study showed. Seasons, however, play an important part, according to Dr. Wilson G. Smillie, of the Harvard University School of Public Health. All types of the disease were less prevalent in the summer and early fall than in winter and spring.

IF scarlet fever antitoxin is given within the first day or two after a person has become sick with scarlet fever, the disease is much less severe and complications are less likely to develop, according to Dr. Luke W. Hunt, of Chicago. His report was based on a study of more than 2,000 cases, in nearly 900 of which the antitoxin was given. If enough antitoxin was given early, the rash faded within twenty-four hours and the fever fell several degrees. An important discovery was that the subsiding of these symptoms made it possible to find the complications which are more to be feared than the disease itself.

INFECTION of the esophagus, the canal which connects the throat with the stomach, leads to thickening of the layers of tissue in the organ. As a result, the tube may become so narrow that food can pass only with difficulty, if at all. This condition was described by Dr. Harris P. Mosher, of Boston. He demonstrated a method of determining where the thickening is and of stretching the tissues to widen the opening so that the patient may swallow comfortably. The infection may arise in the esophagus itself, or infection in other parts of the body may harm the canal. Dr. Mosher found some narrowing of the canal in persons who had pneumonia, ulcers of the stomach, infections of gallbladder, kidneys and other organs and in other conditions.

IF your shoulder has been gradually getting painful and stiff, for no apparent reason, it may be that you have torn the tendon which helps to support the shoulder joint. This tendon may be torn by a sudden jerk or by repeated strain without your knowing it at the time. Dr. E. B. Fowler, of Chicago, found 56 such ruptures in a study of 340 shoulders. Because there is little or no pain at the time of the tear, the injured shoulder is generally not seen by the physician until the patient is severely disabled. Immediate rest would probably result in complete repair of the tissue without other treatment. If rest does not relieve the condition, Dr. Fowler recommends an operation to determine whether the tendon actually is ruptured.

HOW surgeons can reattach the lining of the eye that has become separated by disease or accidental injury was told by Dr. Peter C. Kronfeld, of Chicago. In the condition known as "detached retina" the inner coat of the eye, the retina, which receives the optical image, may be partly or completely detached, with disturbance or loss of vision. The eye can be restored to nearly normal function so that the patient's vision is nearly normal, if the operation is done within a reasonably short time. The age of the patient also has a bearing on recovery, older patients being less fortunate in this respect. The condition affects color vision as well as vision in general. In the cases in which a color blindness for blue and green was noted, this defect was corrected.

A QUEER condition of sensitiveness to heat, cold or effort was demonstrated by Dr. W. W. Duke, of Kansas City, Missouri. He calls the condition physical allergy. The patients have many of the symptoms of sufferers from allergy due to pollens and food proteins. One patient became much depressed and was reduced to tears by warmth and exertion. With cold applications she got immediate relief from her depression and was seized with uncontrollable laughter. Another patient raised his arm three times and had convulsions. Relaxation and relief followed cold applications. Headache, asthma, partial blindness and skin eruptions were also caused by slight effort and relieved by cold applications. Temporary relief may be obtained by applying the opposite of what caused the attack. Permanent relief in many cases, amounting to cure, was obtained after six months of treatment.

HAY fever sufferers who have neglected to go for treatments until their pollen season has arrived and have

found themselves sneezing and sniffing can still obtain relief by treatments during the season. While physicians specializing in the treatment of these disorders have for some years recommended desensitizing treatment before the hay-fever season started, the association endorsed both methods of treatment. It finds that treatment during the season gives satisfactory results with the use of air-conditioned rooms in which temperature and ventilation are regulated, as in many theaters and some trains, and gives promise of being as useful in treating hay fever and asthma as the desensitization treatments. However, this new method is still in the investigative stage. Its chief disadvantage is the high cost of installation. Patients are not advised to install such rooms in their homes for the present, until further study has established their value.

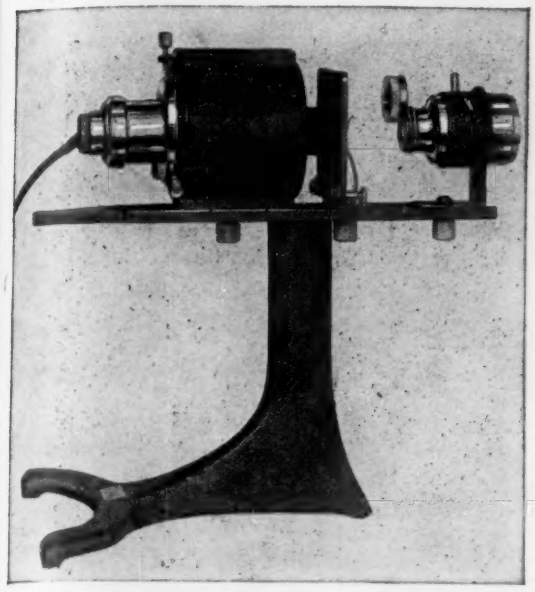
A THREE-HOUR bath in tannic acid as a feature of the modern treatment of extensive burns was described by Dr. Donald B. Wells, of Hartford, Connecticut. The use of tannic acid relieves the pain sufficiently so that the burned areas can be thoroughly cleaned. In this way infection can be prevented. Infection alone was the cause of the exhausting illness, many of the complications and a majority of the deaths from burns in the old days. The person with extensive burns is placed in a large tub of tannic acid solution, according to Dr. Wells' plan of treatment. "He receives quantities of liquids to drink, in order to balance the loss of water. As soon as his pain is somewhat relieved, several attendants begin to work. For three hours they remove burned tissue as the solution loosens it and clean unburned areas with soap and water. By the time the patient is ready to be placed in bed a tan has formed over the burned portions. Then for seventy-two hours warm air is blown on him from an ordinary hair drier, while he is more or less constantly sprayed with tannic acid solution. After this the blower is used alone until the tissue has become perfectly firm, for only a little perspiration may break it and invite invasion by germs." The method is especially successful in burns from gasoline explosions, ignited clothing and extensive scalds. It can be used in any well-equipped hospital.

BURNED faces are more numerous now as a result of the machine age than they were in war time, according to Dr. Howard L. Updegraff, of Hollywood, California. Dr. Updegraff described the methods by which burned faces are restored and reconstructed. Surgery plays an important part, but chemistry and gland treatment are helpful and the final procedure is instruction in the use of make-up. For this purpose a professional make-up artist is employed in Dr. Updegraff's hospital. The instruction in the use of make-up has brought about a great improvement in the mental attitude of the patients, many of whom naturally feel that their fate is hopeless. Before the make-up artist starts instructions, however, the surgeon has done his work, which begins by study of old and new photographs of the face. Plaster models are also used. The actual operative work is usually delayed until the burns have healed. Eyelids are made from skin from another portion of the body. The membranous lining of the lid is supplied by taking a graft from the mucous membrane lining of the mouth. Eyebrows and even lashes are made from pieces of scalp. Noses, lips and ears are also reconstructed.

THREE means of controlling and preventing outbreaks of food poisoning were suggested by Dr. J. C. Geiger, San Francisco director of public health. First of the three measures is regulation and supervision of all persons who handle food. Second is thorough inspection of plants where food is prepared. Third, and most essential to real control of the situation, is education of the public. Food poisoning is as definitely preventable as smallpox or diphtheria. Yet, like those two diseases, it continues to occur because preventive measures are neglected. While outbreaks of food poisonings are so frequent as to constitute a challenge to students of public health and preventive medicine, Dr. Geiger believes that only a small proportion of the cases that actually occur are reported.

DR. PHILIP B. MATZ, of the U. S. Veterans' Administration, Washington, stated that gas warfare is the most humane of the methods of warfare. He pointed out that of 70,752 casualties as a result of gas in the American forces during the war, only 200 died immediately. The results of a careful investigation of the clinical records of nearly 500 men gassed by various gases were presented. Most serious after affects appeared in cases of gassing with phosgene. In this group a number of cases of nervous and mental ailments as well as lung diseases developed. The gas was not directly responsible for the mental ailments, but its severe effect on the individual man, particularly the swelling of the lungs which interfered with breathing, provided the exciting factor in persons with a constitutional defect of brain and nervous system.

ALTHOUGH the American Medical Association is opposed to state medicine, it was pointed out at one of its sessions that during the present economic situation we are actually having a modified form of state medicine. Fifteen per cent., almost one sixth, of the families in New York State, exclusive of New York City, are receiving medical care through state aid, according to a statement made by Dr. Thomas Parran, Jr., N. Y. State health officer. In addition to comprehensive health laws for the prevention of disease, the types of care now given by government agencies include treatment of mental disease through a system of hospitals; child guidance clinics and clinics for after-care; treatment of tuberculosis; care and treatment of crippled children; the construction and operation of public general hospitals; physical examination and corrective treatment of school children; treatment of venereal disease; state and local diagnostic laboratory service, and the state-wide program for furnishing general medical care as a necessity of life as part of emergency unemployment relief.



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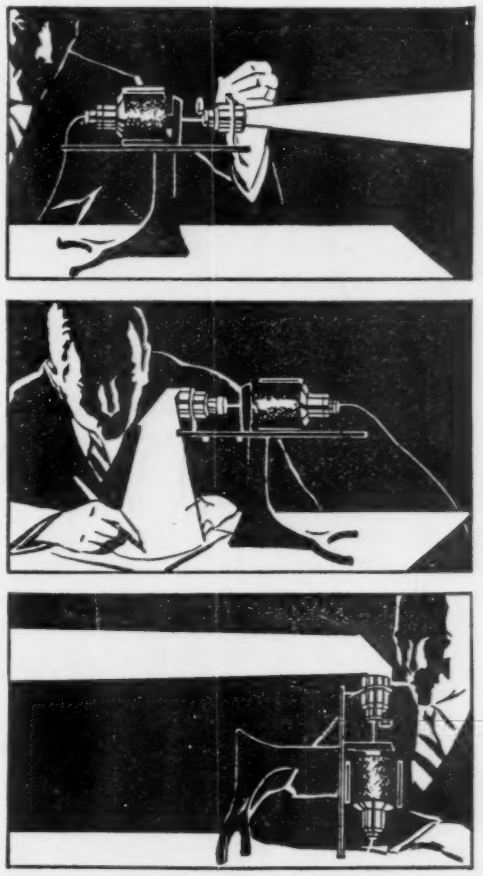

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SCIENCE NEWS

Science Service, Washington, D. C.

PAPERS READ BEFORE THE CHICAGO MEETINGS OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

MAN'S superior brain makes it possible for him to live in a world of extreme kinds of weather and other varying conditions, according to Professor James Barcroft, the British physiologist, a Century of Progress guest. The highly evolved brain of the human being holds unconscious control of his blood's chemistry and physics. The resulting constancy of his blood conditions make him relatively independent of heat, cold and other changes in the outside world that hamper the lives of his less fortunate lower animal kin. In the evolution of life, as pictured by Professor Barcroft, efforts of the lowest organisms to make themselves more at home in the world were at first aimed merely at so arranging their own lives that outside conditions would be less hard on them. They did not make much progress at changing and controlling their own internal conditions. Higher in the evolutionary scale, Professor Barcroft believes that the first steps toward internal regulation were chemical. Then control by the nervous system began to assert itself until finally the brain became dominant in maintaining the continuing uniformity of the blood.

PROFESSOR C. U. ARIENS KAPPERS, of the Central Dutch Institute for Brain Research, Amsterdam, told of researches that upset the old idea that the shape of the skull is always determined by the growth of the brain in its earlier stages. He has found that the skull often determines the shape and size of the brain. The small brain of a fish has plenty of room, even in the small space allowed it in the fish's skull. On the other hand, the bird's skull compels the brain it contains to fold and pack itself closely to make use of relatively limited space. Similarly among human races the various skull types—long, medium and broad—have been shown to influence the arrangement of the parts of the brain. There is, however, as yet no evidence that this influence of skull on brain makes any one race superior to another.

POTENTIAL food substances equivalent to twenty thousand times the wheat harvest of the world are dissolved in the waters of the Atlantic Ocean, according to Dr. August Krogh, the Danish zoologist. This immense amount of organic material is wasted unless it is found that, as some investigators have suggested, bacteria and microorganisms, as yet unrecognized but possibly existing in the depths of the sea, are turning it into food that larger units of sea life can eat and thus utilize.

HEREDITY is not a matter of chromosomes and genes alone. The jelly or protoplasm of the cell that surrounds these specialized living bits within the cell has much to do with whether people are tall or short, blonde or brunette. Professor Richard Goldschmidt, of Berlin's Kaiser Wilhelm Institute for Biology, reported that experiments on lower animals show that the cytoplasm, or bulk of the cell, has a distinctly modifying action on the genes, or chromosome units, that American research in the past three decades has shown to be the bearers of heredity. Genes give orders, but Dr. Goldschmidt's conception is that the surrounding cytoplasm does not always stick to the ordered plan, but acts like craftsmen who sometimes insert their own innovations.

WHEN motion stops, the organism is dead. This is the thesis of the French biologist, Dr. Jean Dufrénoy, of Bordeaux, who explained that within the living plants and animals that we consider the most stationary and motionless there is a ceaseless and intense motion of the protoplasmic jelly that makes up their cells. The more alive a cell is, the more furious is its motion, presenting a large surface to the nourishing sap or liquid. When death comes, three things happen: The protoplasm stops moving, its surface decreases markedly, its smooth unmarked granules break up into granules that can be seen only with the powerful ultramicroscope.

DR. EMILIO MIRA, of the University of Barcelona, Spain, speaking before the psychologists, stated that fear, rage and affection are the three basic human emotions that form the foundation of human moral behavior types. Fear gives rise to moral systems that express themselves in prohibitions and compulsions. Among children and people of low evolutionary level such systems are most fully developed. Rage induces the morals of anarchy and focuses upon material pleasures. True and human morality, in Dr. Mira's definition, is based on the third emotional state of affection.

THE Tropics would be hotter than they are and the Polar regions would be colder, were it not for the fact that there is an immense aerial interchange of heat in the winds, according to Professor J. Bjerknes, Norwegian meteorologist, also a guest of the Century of Progress. The most heat from the sun arrives upon earth in the equatorial zones and the least at the poles. The equatorial zone receives more heat than it radiates away and the polar caps receive less than they lose. The air transport system used by the Tropics in sending their surplus heat to the Arctic and Antarctic is the winds. Professor Bjerknes computed that it would take 303 millions of tons of air traveling across latitude thirty degrees to do this. Large as this sounds, the wind need travel only about six feet a second. Professor Bjerknes visualizes the atmosphere dividing itself into sections that can be called compartments and each maintaining its own circulation, with the usual trade winds nearer the surface and in some cases an anti-trade wind rushing along much higher. To get more information on just how and when the winds blow to equalize the heat on the earth, Professor Bjerknes urged investigators to send up sounding balloons with radio reporting weather in-

struments to signal what is happening in the regions above the Tropics.

FOR the first time in history "H" has been knocked out of matter by artificial means. The "H" in this case stands for hydrogen. The ejection of a proton, or hydrogen heart, from a collision between a heavy-weight hydrogen atomic heart and a carbon atom, reported by Professor E. O. Lawrence, of the University of California, is considered an important step forward in our knowledge of the constitution of matter and its relation to energy. Professor Lawrence, with his unique "merry-go-round" magnetic device for accelerating atomic projectiles, hurled some of the newly discovered double-weight hydrogen atoms at carbon of mass twelve. The carbon gained one unit of mass, or weight, and a hydrogen atom of ordinary weight was expelled in the form of a proton. One and a half million volts was fed into this synthesis and seven and a half million volts were emitted, which is a large release of energy. About two decades ago Lord Rutherford, in England, was the first to perform an atomic synthesis and knock "H" out of matter. He used the streams of helium atomic hearts, or alpha particles, that are released in the radioactivity of radium and other elements. Professor Lawrence's success in performing synthetic transmutation of a heavier element out of a lighter one with significant release of energy is an important new development.

NEW successes in a new method of element transmutation were announced by Dr. J. D. Cockcroft, from the Cavendish Laboratory, at Cambridge. The idea that atomic particles have wave-like properties and can force themselves into the hearts of atoms led to atom smashing that released very large amounts of energy. Lord Rutherford's first transmutations two decades ago were atom building without energy release. Dr. Cockcroft first turned lithium and a projected hydrogen heart into two helium atoms. Now he announced the disintegration of boron into three helium atoms, the breaking up of fluorine into oxygen and helium and the change of beryllium into lithium and helium when bombarded with hydrogen.

DR. THEODOR SVEDBERG, of Sweden, a recipient of a Nobel prize in chemistry, told how he had used the ultra-centrifuge, which is a scientific spinning top, to discover how many weights of proteins there are in blood serum. A few drops of blood and other complex substances, such as dyes, carbohydrates and hydrocarbons, whirled with 300,000 times the force of gravity, are separated, although the kinds of materials in them are extremely close to being the same weight. Dr. Svedberg photographs the substances while they revolve at high speeds. Living organisms can survive the terrific pull upon them in an ultra-whirling top, a force nearly three million times that to which our bodies are subjected by the ordinary force of gravity, as shown by experiments made at Stanford University.

EXPLANATION for the long-known but little understood tendency of wild plants to "sport" new varieties freely when introduced into cultivation, which they rarely or never do so long as they are in the natural state, was advanced before the botanists by Sir Daniel Hall, director of the John Innes Horticultural Institution. An earlier theory, accepted by Charles Darwin, held that plants were somehow encouraged to produce these new varieties by the better nourishment and care they got under cultivation. This theory made environment dominant over heredity. Sir Daniel held that the true explanation is to be sought elsewhere. Many, perhaps all, wild species bear within their germ-cells some of these varying traits, but they are "recessive" characters and are masked by their corresponding "dominants," also present. Whenever, by any thousand-to-one chance, a seed is formed that might produce a variant plant if it grew, the chances are still heavily against its reaching full growth; for in nature hundreds or even thousands of seeds are scattered for every one that grows. Furthermore, the chances are always that a new departure will have less "survival value" in the evolutionary struggle than the old, conservative original pattern, which has proved its worth against stern competition. So in the natural plant population the recessives stay buried. But when a gardener brings a wild species into his breeding ground, he first eliminates the chances against the seeds. Instead of only one in a thousand being allowed to reach maturity, something like nine hundred in a thousand are encouraged to grow. Thus the chance recessive combinations have an opportunity to come out and be seen. If they happen to be something that the gardener thinks is valuable—new color in the petals, new flavor in the fruit—he will single them out and inbreed them, preventing the re-masking by dominant characters that would be their fate in the cross-breeding of the wild state. Moreover, the gardener is not concerned at all with the natural "survival value" of an emerging character. He will shield the most ill-adapted plant, against all competition and enemies, if it has something he wants. If he happens to be a scientist rather than a commercial gardener, he will help even the most crippled and misfit plants to breed, should they promise biological information. In this combination of the encouragement of all seeds to develop to full growth, and the discouragement of re-immersion in the type and the checking of the ruthless course of natural selection, human choice gives the "recessives" repressed in nature their opportunity to express themselves. This does not preclude the arising of wholly new "mutations" in the cultivated stock, which were not present in the germ-plasm of the wild plants. These brand-new variations also occur, especially when encouraged to do so by such modern artificial means as x-raying or radium treatment. But these new mutations are much rarer than the segregation of the recessive characters that were always there but never had a chance.

DEATH is a great parting, not only between him who dies and his friends, but between the most intimately united parts of the microscopic cells of the body. When death comes, the constituents of the protoplasm part company. How this is seen in the dying cells of

plants was described by Dr. Jean Dufrénoy, of the Plant Pathology Station at Brive, France. Living protoplasm, Dr. Dufrénoy said, is smooth, uniform, without even ultramicroscopically visible markings. As it streams around the cell, the only way its progress can be marked is by watching certain foreign bodies included in it, such as crystals and oil droplets. These show its movements as chips on the surface and loose pebbles on the bottom show the current of a crystal-clear brook. But when death comes, all is changed. The flow of the protoplasm slows down and stops, and the highest powers of the microscope disclose the appearance of numberless granules—the sure sign that the once uniformly assimilated substance has broken down and separated into distinct and unlike parts. While a cell is living, Dr. Dufrénoy continued, all its vital activities are carried on at the various surfaces of its protoplasm, where they front on its sap cavity, oil droplets, etc. Its chemistry is all surface chemistry. An outstanding exchange, indispensable to the continued life of the cell, is the taking up of oxygen and the voiding of carbon dioxide. The more active the cell, the more surface it exposes for this and other chemical exchanges, by throwing out extra folds and filaments of its protoplasm. But there can be too much of a good thing, in plants as well as in human beings and animals. Dr. Dufrénoy described a condition seen in the cells of plants afflicted with certain diseases, where there is an excessive development of these oxygen-exchanging protoplasmic surfaces. An examination of the respiration of such plants shows it to be much in excess of that of healthy plants: the sick plants are suffering from a real fever.

TWENTY thousand pairs of photographs were taken at the University of Chicago to show what occurs when an atomic nucleus is disintegrated when it is struck by a neutron—an atom of zero atomic number and zero electrical charge. So Professor William D. Harkins told the American Physical Society. Among the results of this long research, Professor Harkins enumerated the following: The slowest neutron which disintegrated an atomic nucleus had a velocity of 11,000 miles per second. The highest velocity for any neutron was found to be 35,000 miles per second, or about one fifth the velocity of light. This is an extremely great velocity for a particle of the mass of an atom. The energy of this neutron was extremely high, 16,000,000 electron volts, or very much higher than could be obtained by any artificial means now known. The mean velocity of the neutrons which disintegrated nitrogen nuclei was found to correspond to a temperature of 46 billion degrees. Such a temperature is not attained except possibly in the interior of a star. Since nothing is known by astronomers about the temperature of the interior of a star, except that it is very high, anything may be assumed. The nuclei of nitrogen atoms were found to disintegrate relatively often, while those of carbon and neon are very much more difficult to disintegrate. Evidence was obtained that the neutron, when it causes the disintegration of an atom is itself captured by the nucleus of the atom, but no good evidence was obtained to show that any disintegration can occur if the neutron is not captured. It was found that when an atom is disintegrated by the impact of a neutron, energy disappears, and gamma-rays, a very penetrating form of radiation, much more penetrating than x-rays, are given off. A new apparatus has been built for the photography of atomic disintegrations or syntheses. During the last day of operation this apparatus gave 6,400 pairs of photographs of excellent quality. Two motion picture machines are used to take the photographs, and to aid in the mathematical analysis of the photographs. Professor Harkins has suggested the name Neuton for this new element made up of all of the free neutrons in the universe. This is in many ways the most remarkable of all of the elements, since it is as different from all the others as the number zero is different from all positive whole numbers.

BRIGHT light "cures" nerve tissue poisoned with carbon monoxide in much the same manner that oxygen revives nerve tissue asphyxiated by oxygen starvation. This was announced by Professor Herbert Gasser, of Cornell University Medical College. When a nerve is stimulated it develops a sudden high charge or potential of electricity which comes and passes in a few thousandths of a second. This is followed by a longer period of milder electrification called the "after-potential." This potential can be diminished by various types of poisoning including carbon monoxide and asphyxiation. The after-potential is not only restored to normal but is raised above the usual level by the light or oxygen "cures."